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ABSTRACT

In "The Research University of the Future," the first of five papers compiled here, Kenneth R. R. Gros Louis chronicles the history of research universities with emphasis on the past two decades and discusses issues and concerns related to the future of the university as well as the research library. In the second paper, "The Future of Technology in Libraries," Richard W. Boss discusses functionally integrated library systems, i.e., systems in which all automated functions share a central database, the same command structure, and the ability to access all functions from one another. In the third paper, "Educating Research Librarians for the Future," Evelyn H. Daniel recommends a doctorate as the appropriate credential for academic and research librarians in the future, and discusses bringing together the academic library and the campus computer center. In the fourth paper, "Satisfaction Guaranteed or Your Money Back: The Problem of Performance Standards for Academic and Research Libraries," Paul B. Kantor discusses the creation of standards that involve qualities which are meaningful to those who manage, use, and pay for the library. In the concluding paper, "Long-Range Strategic Planning for Information Resources in the Research University," Robert M. Hayes considers the issues and problems involved as well as needs for research in the context of planning the future of research universities, giving as an example a plan instituted at the University of California at Los Angeles. (SD)

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ISSUES IN RESEARCH LIBRARIANSHIP

Proceedings of a Forum Series
Co-Sponsored by
Indiana University Libraries, Bloomington
Indiana University School of Library and Information Science
January - April 1987

Papers Presented By

Kenneth R.R. Gros Louis
Richard W. Boss
Evelyn H. Daniel
Paul B. Kantor
Robert M. Hayes

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Preface

The papers reproduced in this publication were delivered as part of the Forum Series--a collaborative effort between the Indiana University Libraries and School of Library and Information Science (SLIS), supported through a grant from the Council on Library Resources. Each paper was presented to a large audience of librarians, SLIS faculty and students, and interested faculty, students and staff from other sectors of the University. The lectures were followed by informal receptions. Lively discussions took place during the receptions, often initiated by the question and answer sessions which concluded the lectures. Each guest lecturer ended the afternoon in a seminar with the students enrolled in the specially-designed course, Issues in Research Librarianship.

This publication, therefore, captures only a part of the excitement generated by the speakers during the semester in which the course was offered. We wish to share the papers because of the quality of the contributions in the hope that readers will share some of the intellectual enthusiasm we felt. We are especially grateful to the distinguished speakers who joined us.

Stella Bentley, Anne Rimmer, and Barbara Dewey formed the Indiana University planning group. Darlene Weigand and Shelia Creth spent a day with

us as consultants; their advice was invaluable in developing a program from an idea. Marilyn Shaver and Barbara Dewey assisted throughout the semester and edited this publication. We appreciate the contributions of all.

Finally, we thank the Council on Library Resources. The Council's importance to the library community is nowhere better illustrated than in the catalytic role it played in this program. First, awareness of the funding opportunity permitted us to "stretch" a bit more than we would have, had we felt constrained by our own resources. And by providing the support for the program, the Council gave us the opportunity to try a different approach--one from which all participants benefited greatly.

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Kenneth R. R. Gros Louis

"THE RESEARCH UNIVERSITY OF THE FUTURE"

[A Version of the following remarks was given at the inaugural symposium of the Institute for Advanced Study, Bloomington, Indiana, September 1963]

It is clear to all of us, to any casual observer, that the functions of the research university are changing. Change is a familiar phenomenon for academic institutions, but like change in our society, it is rapidly accelerating. One of the major reasons we are here today, one of the questions we have on our minds, is whether the university can remain in control of its basic system of values, its basic integrity, in an era of greater involvement with government, more involvement with industry, more expectations on the part of society that we produce services to meet its desires, courses and knowledge to fit its immediate, often short-range needs.

To answer that question, we must consider the changes our society itself is going through and will go through; we must examine the modern history of the university in light of those changes, both expected and actual, consider the future of higher education in America in the context of the many tensions within its structures, and, finally, perhaps most importantly, we must ask ourselves: What business are we really in? What should a research university really do?

Charles Homer Haskins writes in The Rise of Universities, "The very name university, [means] an association of masters and scholars leading the common life of learning. Characteristic of the Middle Ages as such a corporation is, the individualistic modern world has found nothing to take its place." Haskins pointed out sixty years ago, "The essentials of university organization are clear and unmistakable, and they have been handed down in unbroken continuity." Another reason we are here today, and why this forum is

likely not to be the only one of its kind, is that many now feel the need to re-examine Haskins' assertion that the essentials of university organization, handed down through the centuries, continue unbroken. James Perkins wrote some dozen years ago, "Organizationally the university is, in fact, one of the most complex structures in modern society; it is also increasingly archaic. It is complex because its formal structure does not describe either actual power or responsibilities; it is archaic because the functions it must perform are not and cannot be discharged through the formal structure provided in its charter."

We might agree that the first research university as we know it was in Bologna, where teachers who were leaving the university were required to turn over copies of their lectures for distribution. Many seminal texts in law, theology, and other fields derive from the Bologna experience. We can also trace our earliest troubles with tuition increases to that same institution. The great scholar Odofredus wrote: "Next year I expect to give ordinary lectures well and lawfully as I always have, but no extraordinary lectures, for students are not good payers, wishing to learn but not to pay, as the saying is. All want to know but none to pay the price. I have nothing more to say to you beyond dismissing you with God's blessing and begging you to attend Mass."

Those words also suggest the age of the venerable student tradition of not doing what professors ask. Poor Odofredus has to beg his students to attend Mass; now, we may implore our students to do their homework better or at all, to care about things other than job prospects. The Middle Ages provide our first documented incidence of university fund drives, albeit one conducted for dubious purposes. In his De conscientia, Robert de Sorbon, founder of the University which bears his name, comments on final examinations: "If any student is rejected by the chancellor, he may be

reexamined after a year, or it may be that, through the intercession of friends or by suitable gifts or services to the chancellor's relatives or other examiners, the chancellor can be induced to change his decision." Such corruption did not bother the chancellor of Paris, because "at the Last Judgment the sentence will be final, and there will be no help from wealth or influence...the Great Chancellor will refute the sinner in full university before the whole world."

Commencement rituals have also changed somewhat. In Bologna, a degree candidate's parents were notified of his graduation as follows: "Sing unto the Lord a new song, praise him with stringed instruments and organs, rejoice upon the high-sounding cymbals, for your son has held a glorious disputation, which was attended by a great multitude of teachers and scholars. He answered all questions without a mistake, and no one could prevail against his arguments. Moreover he celebrated a famous banquet, at which both rich and poor were honored as never before, and he has duly begun to give lectures which are already so popular that others' classrooms are deserted and his own are filled."

The research university remained remarkably stable until the second half of the 19th century. Derek Bok, in Beyond the Ivory Tower -- the title itself alerts us to a changed function for the research university -- reminds us that "Before 1900, American universities were small institutions... whose principal function was to provide a college education that emphasized mental discipline, religious piety, and strict rules governing student behavior. Thus conceived, they remained quiet enclaves, having little direct impact on the outside world. ... In those days, less than 5 percent of the nation's youth attended college; there were no large endowments, no foundation grants, no federal funding."

Soon, however, the Morrill Act made possible the Land Grant colleges and the study of agriculture and other applied disciplines within the public university. Then the natural sciences, particularly biology, became part of the curriculum. Their acceptance, however, as Robert Nisbet points out in The Degradation of the Academic Dogma, did not come easily. Nisbet claims that the natural sciences are less Western hemisphere-centered than literature, history and the classics, which at that time formed the bulk of the research university's interests. Therefore, Nisbet argues, the very addition of the natural sciences began to break down the traditional research university, to change its function significantly.

Bok is less critical than Nisbet, less beholden, in fact, to the notion of the pristine research university. Bok sees the trend toward agriculture and applied disciplines as a strand competing with pure research and with the desire to see the university as a vehicle for promoting morals and a liberal culture in what was then a rough-and-tumble America. "By 1910," he writes, "these competing visions had somehow joined together in an uneasy coexistence, and universities were beginning to grow at a rapid pace both in size and in public esteem." Applied studies, pure research, the University as promoter of cultural values, functions, competing visions, uneasy coexistence.

We might pause over that word "uneasy." Many of the problems faced by today's research university and the university of tomorrow may relate to our inability to make that uneasy coexistence work better. A liberal education -- the core of a research university -- should be able to include training in technique as well as training in vision. The liberal arts and professional education should be able to form a partnership, not foster a competition. To do that, we may need to develop new ways to structure our schools and programs, to arrive at new conceptions of how we define our disciplines, few

of which have existed even for a century. Most of the mechanisms and processes in place in our universities, even some of our newer thrusts, are designed to maintain the status quo. Will that be good enough in the next century if universities are to remain the principal creators, guardians, and transmitters of knowledge?

The growth of the research university in the early part of this century called for massive amounts of money, the kind of giving, Bok notes, that led to donor control over academic decisions. George Wharton Pepper could fire teacher Scott Nearing from the University of Pennsylvania in 1915 for this reason: "If I am dissatisfied with my secretary, I would suppose that I would be within my rights in terminating his employment." At Stanford, Mrs. Leland Stanford objected to a faculty member's speeches on Chinese immigration and ordered the firing of economist Edward Ross, causing the protest resignations of seven others. Incidents like these, as most of you know, led to the formation of the AAUP, to the growth of the concept of tenure, to the broad understanding of the principle of academic freedom, to a university detached, an institution neutral.

These privileges, these responsibilities, are shared by the research university with many other kinds of higher education systems in American society. But in discussing the research university, we include those major state-supported and private schools which offer a substantial number of doctoral programs, and therefore a small percentage of the postsecondary institutions in the United States. Nevertheless, this small number establishes patterns for all, maintains the principles of operation, determines the distribution of effort or function, forms much of the public's attitude toward higher education. Research universities are distinctive because of their massive library collections, well-equipped laboratories,

presence of scholars who know through long periods of reading and study the history of our culture's major issues, scholars whose interests are diverse, whose independence, in several senses of the word, goes unchallenged. The research university is involved in searches and quests, in the kind of study which is indeed "advanced," which goes beyond what might be learned at other institutions of higher education. How carefully these distinctive features have been preserved, how well the principles which led to the founding of the AAUP have been followed, how much the research university has departed from its traditions -- exploration of these topics may help us understand the significance of the research university's changing functions.

Some would agree with Nisbet that the consensus that held the research university together for 700 years was: "Knowledge is important." No particular kind of knowledge was said to be more important than another, although for 700 years the research university limited itself to the study of only a few things; if there was a pecking order, according to Nisbet, it held that the less immediately practical a field of knowledge was, the more esteemed. Further, the knowledge that was preserved, advanced, and studied was exclusively Western. This, it seems to me, is not the best of ideals around which to build an institution. Still, the tenet "Knowledge is important" is not significant for what it says, but that for all the parochialism, elitism and arrogance that may have resulted from its centrality, it seems to have worked. The research university thrived, although in ways perhaps not amenable to our contemporary set of values. Disciplines never were equal, and such a paradise-lost script will not adequately describe the history of the research institution. Kurt Vonnegut, writing on the nature of communities (or, as he calls them, folk societies), cites the case of one of the most successful communities he knew, one held

together by an irrational love of spaghetti. Nisbet and Vonnegut are not typically linked; yet from them we may get the same message: faith in a central tenet, or dogma, or governing vision, will hold a community together; from that faith will surely come works of value.

In the 1960's, one of the best-run organizations in the world was the National Aeronautics and Space Administration. Its governing vision: "To land a man on the moon and return him safely to earth by the end of the decade." In the 1970's, we might cite the governing vision of the Apple Corporation's founder, Steven Jobs: "To put a computer in every home." More recently, consider Lee Iacocca's single, persuasive message: "_____." These are well articulated, precise missions; they capture the imagination and energize intelligence. The university mission used to be to preserve, advance, and propagate knowledge in the classics and the humanities. That was our function, despite inroads from society that led to uneasy alliances. Obviously, that has changed. Other, more practical, more modern concerns have intruded on the traditional governing vision of the research university, perhaps forcing us to live with multiple missions. Areas of knowledge which once comprised the entire university are now at the low end of the list of priorities. As Nisbet says, "The Homeric or Chaucerian or Miltonian scholar no longer walks as tall on the campus as either the physician or the lawyer or the engineer." If we agree with this statement -- and it seems to me difficult to dispute it -- how deeply should we care about its implications?

We would like to believe -- indeed proclaim -- that all research is equal, but money, the primary indicator of status in our culture, suggests otherwise. It does more than suggest -- it shouts. Much of the disparity between disciplines began during World War II when many academics gave up their independent research to work for the governmental war effort. In a

memorable scene from the movie The Day After Trinity, the story of Robert Oppenheimer and the making of the atomic bomb, a now-retired mathematician from the University of Wisconsin talks of how his colleagues kept disappearing, not saying where they had gone, not writing back. Department of Mathematics social functions and meetings became smaller and smaller, until the point of attending was to see who was the latest to have disappeared. At that same point in the film, a railway clerk from Madison tells of the seemingly endless parade of academic-type people buying one-way tickets to the New Mexico desert. These two scenes say much, I believe, not only about the involvement of the government -- however necessary -- in what had previously been independent research, but also in indicating that the nature of research itself -- at least in the sciences -- was changing, becoming more collective than ever before. Many scholars finished their war work in 1945, of course, and returned to their independent and solitary inquiry, but others did not, and universities have been in various ways and to various degrees financially dependent on the government ever since. They are not likely to declare independence any time soon.

The ties we began to establish in the 1940's with government, industry, business are growing daily. In 1984-85, for the first time, United States business gave more money to colleges and universities - \$1.5 billion - than did their graduates. Major topics each week in the Chronicle include government support and regulation, the institution of research parks, joint ventures with business, new ways of gaining more university support from the private sector. How new are these activities? Do they identify major new functions for the research university? Some assert that we have always been closely linked to, even a tool of, private industry and business. Here is David N. Smith writing in Who Rules the University?:

"Men like Andrew Carnegie, Jim Hill, Jay Gould, John D. Rockefeller, Diamond Jim Fisk, and Commodore Vanderbilt ... recognizing an increasingly urgent need to develop new kinds of administrative and technical skills for their industries, and hoping to immortalize their names, these robber barons began to reinvest some of their giant profits into higher education, on a small scale at first but in larger and larger amounts as the century drew to a close.

This kind of random and uncoordinated philanthropy was an important stimulus to the growing system of higher education in America, but it produced a chaotic and unbalanced growth, allowing universities to sprout like weeds across the country. Then, around the turn of the century, as the process of industrial concentration and monopoly formation quickened, two of the most important capitalists -- Andrew Carnegie and John D. Rockefeller -- established giant foundations designed to impose order on the chaotic universe of American higher education. With the power of vast quantities of money behind them, these two foundations were able to systematically shape and restructure the university system in America in the forty years before World War II. By tailoring the universities to meet the needs of an increasingly powerful but unstable capitalism, Carnegie and Rockefeller transformed higher education into an invaluable instrument of capitalist rule."

Many of the facts that underlie such an analysis of the origins of the modern university are not in dispute; what differs is perception. Smith and other critics of the universities as institutions seem willing to ascribe heinous motives to their financiers, to assume that within the man whose troops would fight with union strikers there can be no good.

Robert Nisbet blames the universities for the crumbling of their own academic dogma. "Scratch a faculty member today," he quotes a corporate executive, "and you almost always find a businessman." Nisbet charges that we have allowed the function of teaching -- the dissemination of information and knowledge to our students -- to dwindle, that we have let our best researchers avoid teaching through their presence in various centers and institutes which are only peripherally linked to the academic departments that once were the cornerstones of research and teaching. We have, he argues, moved into an era of "higher capitalism," with the sciences leading the way, followed in short order by education, the social sciences, and the arts and humanities. Our level of agreement with Nisbet may decrease as we run through his list, for artists and humanists are unlikely to participate in the "higher capitalism"

Nisbet describes, thus underlining the potential crisis for the arts and humanities in the future research university. Nisbet suggests that the kinds of research and development that universities now do at government and industry behest would be better left to those who remain totally independent of the university structure.

Whether we go along with Nisbet -- and he writes out of a distinguished tradition of defenders of the university (if you agree with them) or of golden age nostalgics (if you disagree with them) -- we might accept his notion of the degradation of the academic dogma positively, within the context of what has happened in our society. The rise of independent research institutes within universities, for example, seems directly related to the change in the nature of scientific and technological research, which answers to and anticipates both the direct and indirect needs of our world. We might turn the concept of "degradation" on its head, in fact, look at the changing nature of our society first, and then consider where the university must and will fit in. The research university, I believe, reflects the critical questions facing the culture it serves and preserves.

A different America, indeed a different world, will surely influence the functions of a research university, just as those functions were transformed by changes between nineteenth and twentieth-century America. How much of the core we retain is at issue, as it was then. What kind of uneasy co-existence we arrive at is part of our question, as it was then. We live, as someone has said, in a time of the parenthesis. Our industrial, manufacturing society is like the ghost of Christmas past, still with us, but doomed to come no more. Rapid technological advances require brain-intensive activities that are altering our concepts of time and space. When we talk of the economy, we include the entire globe; when we plan for recoveries from recessions we look

beyond the next local or even national election. The opening up of space and time has led to a corresponding focus on individuals, community action, self-help books, quality circles, multiple options for self-expression. One of the ways we seem to be coming to terms with mechanization in a global context, in other words, is to turn inward for a little private breathing space, with a small group of others. Those of us who work in the research university cannot ignore these changes, even though we may believe that our thinking, our attitudes, our ability to make decisions, have not yet caught up with what is actually happening.

Inextricably, we are linked. This may mean that collaboration on various forms of research will soon cross national lines to a degree unprecedented in world history, a degree so great that our notion of research may become fundamentally different. It may mean that there will be less competition between researchers in Boston and those in Tokyo, for example, and more collaboration. Surely we can respond to possible cries of alarm by working out problems of publication credits and tenure decisions; surely we must allow enough flexibility in bureaucratic matters to enable researchers to do what needs to be done, where and when it needs to be done. That may mean that institutions in different countries (let alone different schools within one university) may share the salary of a researcher. We need world-class administrators with world-class imaginations to keep up with our world economy, our world community of scholars.

In a way, universities have probably done as much or more than corporations to foster a world economy. Our initiatives, after all, produced the insights that led to the inventions which have made the world shrink so dramatically and so quickly, with no end in sight. As professors and administrators of the repositories of the major advances of thought, we must

strive not to catch up to the onset of a world economy, but to anticipate what will happen next. (In writing about the art of fiction, novelist John Barth once proposed that we need not concern ourselves with the "next best thing," but that we need to anticipate the "best next thing.")

Whether it is the "best next thing", futurists and scholars have predicted the arrival of the information-based society for many years. Now, they seem to agree that it has finally arrived. Certainly we see it in the shrinkage of traditional industrial-manufacturing jobs in the United States and the growth of white-collar jobs. Factories that once employed hundreds to manufacture a product now employ fewer than twenty people. Machines that build products not only duplicate the functions of human assemblers, but also diagnose their own problems. An eastern factory which makes printed circuit boards is noted in the Atlantic Monthly for its remarkable lack of human intervention in the manufacturing process. This state-of-the-art plant has only one employee involved in the production process each shift; that person's purpose is to change the circuit boards on machines that break. The machines, since they are self-diagnosing, are able to pinpoint the problem; therefore, a semi-skilled worker can handle the task with no trouble. As this kind of modernization occurs, we may become, more and more, a nation of lawyers, of paracens. of administrators, of service workers, perhaps of the unemployed.

The information society, of course, is more than just a new kind of job. It is something so new and so different from what we are used to that I am not sure we know exactly what it means. John Naisbitt's Megalrends takes a stab at the problem in explaining that in the information age, based on the advent of computers, physical space will be replaced by conceptual space. If this is reasonable, then universities, the home of abstract thinkers and

conceptualizers at a time when conceptualization was out of fashion in a product-oriented world, should be in a good position to provide leadership in shaping the information society.

Much depends, of course, on how we use computer power - on whether we harness it, or let it control us. Even now, computers can facilitate calculations; improve and speed publication; extend and expand the memories of our scholars; bring remote information to faculty offices and homes; accelerate the discovery of patterns; allow visualization of invisible dimensions; enable scholars to alter temporal and spatial scales; enhance interaction with colleagues across the campus, across the nation, across the seas. The university of the future will be characterized by faculty and student workstations; high technology classrooms; on-line information; the integration of computers into all aspects of academic life; links with multiple external data bases; the existence and activities of high speed networks. Getting information will not be a problem in the years ahead. But who will package it? How will access to it be determined? What function will the university play in identifying its uses? How can the research university prevent a drowning in information by those who thirst for knowledge? How can the research university - indeed should it - direct the selection process of the public, the media, and, we must pause if not shudder, the researcher?

Libraries have been, and hopefully will continue to be, the primary human link between faculty/students and data, in paper or other forms. It is with much trepidation that I try to imagine the function of the library in the university of the future. But I plunge ahead, acknowledging that you can make fun of me when I'm gone, and knowing that nothing I say will be news to you.

Libraries have already made much progress in recognizing the need to seek alternative approaches to the traditional means of providing information. A

number of realities seem better accepted by librarians than by the academic community in general: that the concept of a single, self-sufficient, unified research library collection is outmoded; that no research library will be able to maintain in-house collections at traditional levels; that libraries must improve the human capacity of linking users with national bibliographic materials and distant collections; that preservation problems are massive in terms of cost and execution; that technology can locate the existence of materials, but not ensure their availability; that the structure of research activity based on access to knowledge built over the years by the library profession may be obsolete in the information society. Libraries are responding very well, I believe, to conclusions that might be drawn from these observations. Obviously, automation of the library collection and the provision of certain services are a necessity, no matter how high the cost, or how long the period of coexistence between traditional and new methods for collecting, storing, and retrieving information. Equally important is expansion of sharing and cooperation in cataloguing, collection development, preservation programs. Beyond these, of course, is the longer-range aspiration of an intellectual network that can link reference librarians throughout this continent, if not the world.

None of this will be easy, not only because libraries must compete with other university priorities for funding, but also because the library, perhaps for the first time in its long, distinguished history, has competition as a provider of information. It is not for fanciful reasons that library schools have added the word "information" to their names. But it is confusing to the outside viewer to note that computer centers frequently have operations called information centers, that many universities have administrators with titles such as dean or vice-president for information technology, that audio-visual or instructional systems technology departments are inserting the word

"information" into the titles of their degree programs. I would hope that libraries and computer centers might eliminate their competition in the years ahead and work together to create the new learning and research environment. Clearly, the traditional excellence of librarians in direct interface with the academic community must be considered. The richness and complexity of the information available require these skills even more in the future. Assuming the role of the "university information center" also allows for greater cooperation with computing centers. Such cooperation is important for all of us within the university because the private sector, as you know, is also providing competition to the traditional library, introducing the concept of fee-per-use for information, taking advantage of the lack of clarity in copyright laws to seek control of the "knowledge industry." Thus, challenges for libraries - and opportunities - exist both internally and externally.

I certainly have no quarrel with Patricia Battin's vision of the library's future which, as many of you know, includes such components as human gateway access to knowledge; user-friendly access; machine readable data bases and files; high resolution graphics; transmission of journal articles; on-line indexes of books and their tables of contents; access to current scholarship through author-supplied summaries; on-line access to education training and consulting services. But I also have several concerns that I might put in the form of questions: Can libraries respond to their challenges quickly enough? Will librarians or users control the new system? Will the personal computer in offices and homes provide gateway access to the information required by scholars? How will the new library accommodate humanities scholars, whose need is not for distinct pieces of information, but for multiple primary and secondary texts? Will it be possible to maintain the traditional concept that

library services for individual users are free? Will libraries - universities for that matter - be prepared for the students and faculty of the next generation, who will come to us with high computer sophistication and low tolerance for waiting? As libraries and universities address these concerns and the related issues in an information society, it seems to me that the critical need for scholarship, not in one area or another, but for all scholarly endeavor, is to speak with a unified voice, evincing a cooperative spirit, within an extraordinarily complex environment.

How much libraries change their function, their way of doing business, their identities, while retaining their very human approach to their jobs, is, of course, closely related to how much universities themselves change, and we know that institutions of higher education are slow to adopt reform, quick to block innovation. I have noted before that "the traditional pattern in which a 'teacher' delivers 'information about a 'discipline' to a 'student' in a 'classroom' is firmly in place and at times preserved with paranoid fervor. Given some of the developments in contemporary American society, however, it seems likely that internal and external pressures will force institutional leadership to consider alternatives to that traditional pattern."

We must be prepared to teach new and different kinds of students, for example, including laborers who have lost their jobs in the economy's transition, many of them still very young, even after fifteen to twenty years in the work force; retired workers, who face long postemployment lives and who need to develop vocations and skills for satisfying activities; handicapped individuals who have until recently been deterred by the physical difficulty of attending a university; those whose jobs and families happen to place them in communities where there is limited opportunity for higher education. In an information society, we will be called upon to retrain workers again and again and again.

I am haunted by the voices of some of my former teachers -- Jacques Barzun, Lionel Trilling, Sidney Hook -- warning me that the research university cannot be buffeted unduly by temporary and ephemeral currents. But I also recall the student revolts of the 1960s and early 1970s, revolts in many ways prophesied by Trilling, and consider what they told us: that we cannot justify what we have always done by saying that we've always done it. Those turbulent years forced us to ask ourselves a number of difficult questions, and the best universities, those which are going to lead the way in the rest of this century and the early part of the next one, are those which have wrestled most diligently with the questions about their basic natures and functions in the context of the 1960's. I have said in an article in Change Magazine that America is no longer a melting pot; in fact, I believe that the student movements of the 1960's forcefully brought to our attention the fact that ethnic and cultural diversities were to be celebrated in the United States rather than blended into some kind of homogeneous whole. The choices that Americans will be asked to make are unlikely to be between an attractive and a less attractive alternative; rather, they will be between equally attractive, viable, and feasible alternatives. Challenged with these circumstances, it is surely part of our responsibility, even as we work to sort out policies within universities, to provide the kind of education and training that will enable our graduates to make the best choices among attractive possibilities.

And yet, even as we meet, the already complex relationships between research universities and the outside world -- to use an old and perhaps outmoded phrase -- become more complicated as the lure of venture capital pipes away our professors to the prospect of dancing to unfamiliar tunes.

Public institutions are being encouraged in some states to smooth the way for faculty entrepreneurs; private universities are moving slowly into joint agreements that they admit could change the nature of the research university. Voices from many sides, especially the outer side, describe the bright prospects of technology transfer. Voices inside express uneasiness about the potential search for financial gain. Will the research enterprise be damaged? Will the central values of independent research, academic freedom, the principles in which the AAUP was founded, be threatened? Will the entrepreneur have time to carry out the traditional responsibilities of the academic researcher? How compatible are business motives and scholarly collegiality across a spectrum of disciplines? Will the functions of the research university become colonized, the university itself a federation, a conglomerate of intellectual interests with little exchange among the various corporate holdings? For the moment, we have more questions than answers.

Like libraries, universities face many new challenges and problems. Exponential growth in what they are and do, changes in the types of higher education institutions in America, new and complicated forms of financial support, a different kind of American economy - all these factors have powerfully affected, if not transformed, public and private colleges and universities. Consider even that phrase, "public and private" - for the 100 universities that conducted six billion of the seven spent on university research in 1983, for the 167 universities that in 1982 graduated 98% of the nation's new Ph.D's, what is the distinction between public and private? Increasingly, we have what a report-in-progress for the National Association of State Universities and Land-Grant Colleges calls "federal universities," whose future is tied to support from federal and state governments, national

and multi-national corporations, foundations and private philanthropy. Is this development beneficial or harmful? It is clear that universities face serious problems of management, of governance, of identity, of purpose. Faculties have lost confidence in the future.

Universities continue to be odd structures in American society. Their decentralized departmental and school autonomy is both a strength and a weakness. The strengths of the system are obvious and perhaps more than outweigh the inability of smaller units to accept changes that may be in the best interests of the campus or the university. The system also prevents any university in the country from being fully autonomous in that faculty belong to two separate communities - the campus community and the disciplinary one, entities with different perspectives, different functions, constituents, even reward structures. Varying in size and status, each community attracts some faculty members more than others, each considers university priorities based on different standards and measures, more local-oriented for the campus community, national for the disciplinary. Given such bifurcation in ways of seeing, will it be possible for universities to adapt and respond to the needs and desires of society? Daniel Alpert's recent study on "The Organizational Context of the American Research University," is titled, "Performance and Paralysis." The contemporary university struggles to change, but cannot shake off its affection for the status quo. Too many tensions, some have asserted; "dissonances" Alpert calls them. There is general agreement that undergraduate education is in disarray; yet, calls for reform look to the past for solutions. The result is that business and industry, as they have become deliverers of information, are also developing their own educational institutions. Retrenchment plans rarely make fundamental changes; instead, they eliminate, claim that "small is beautiful," and still look the way they

did in the 1960's. The powerful influence of the disciplinary communities discourages career changes for faculty long after other institutions in our society have recognized their benefits. The turn to business and industry for financial support could lead to new developments, but it could also simply replace lost funding from other sources and maintain the status quo. Nearly all current university faculty members must be replaced by the year 2010; preservation and access programs are essential to the continuation of libraries as we know them; physical facilities of most universities are woefully in need of repair and replacement - on the list could go. And yet, higher education searches for means to increase efficiency - to do better what it already does - rather than seeking agreement on goals and priorities that might enhance effectiveness.

In many ways, while the issues are different, the problems facing the contemporary research university do not really differ from those of the early twentieth century. We are faced with several competing visions as we attempt to step back from the day to day business of instruction, research, writing, and administering to think about where we would like to be twenty years from now and then ten years from now and then five years from now and then next year. Those competing visions, as they did in the early part of this century, are likely to move toward some level of co-existence -- how uneasy that co-existence is this time around will depend on our efforts to consolidate our vision of the changes in the research university since the end of World War II by absorbing that transformation and formulating a specific mission for ourselves as we face a society in transition, one at the end of an era, throughout most of which the research university survived with little significant change. The competing visions of the 1980's draw on some traditional views of the university and reflect new ideas about the university.

We are asked increasingly, for example, and this may be more true of public universities than of private institutions (an issue perhaps worth exploring in its own right) to provide more services to the state, to worry less about our national or international reputation and more about activities which will immediately benefit a state's economy. Most of us in public institutions do not quarrel with the requests, but we are uncomfortable about their relation to the research university's function if they might be better left to other agencies. How many useful programs can we create before our faculty and staff are distracted from their research and teaching of traditional students? How much effort should we put into offering our present programs as opposed to shifting resources to new kinds of delivery systems and thereby eliminating some programs? The pressure from state governments for public institutions to serve the state is a version of the emphasis on applied areas in the early part of this century, but it is much more pressing and it comes at a time when the public is much more aware of higher education as a major force in American life, much more conscious of the relation between an educated populace and economic prosperity. Yet another vision sees the University on the verge of becoming an obsolete institution unless it significantly alters its way of thinking about how it operates and how it determines what it will do. It may no longer be a question of what the faculty believes should be offered in teaching, research, and service, but rather a question of what the public wants from the university. We are really talking about market research, about services that respond to that research, about a research university whose activities are determined in part, perhaps in large part, by the public. Behind this view, of course, is a focus on the uses of technology. What we may need to consider, however, is that an increase in the use of technology seems to elicit from individuals an

increased need for closer human interaction. The movement in America toward alternate forms of health care is not only a result of rising medical costs, it seems to me, but also is a reflection of the discomfort with the greater technology in emergency rooms and hospitals. Such a concern leads to a shift away from hospital care and its quality to the quality of how we experience and live through illnesses, to a concern for the quality of how we die.

These competing visions are intertwined with problems we have never really solved. After 15 years of little progress, we must continue to explore how we are to realize our goal of including more women and minorities in our faculty, staff, and administration; how we are to resolve the disparity of pay between disciplines; how we will handle our relationships with foreign governments, the CIA, various wings of the Department of Defense; we must explore whether the research university should include more disciplines, more different kinds of people with more interests, or whether we should begin to scale back to protect the core of what we have always done; we must explore, finally, what the relationship of teaching and research will be in the next generation; and we must decide what we mean when we say we serve our society. What business are we really in? It is striking to think that the original quote, "All art must serve the state" -- a quote which in this context could easily be extended to all research -- was a formulation of Lenin's, and that it led to disaster for free thought and speech in the Soviet Union and elsewhere; the similar calls today by various American political leaders strike a strange, if totally inadvertent echo. Where do we draw the line? We can guide change to protect integrity, and ultimately liberty, or we can allow change to happen by the hands of others. That so many expert and caring individuals are becoming concerned with this issue is a good sign. An even better sign would be if a growing number of institutional leaders asserted

their willingness to take risks; be proactive rather than active; provide vision and a cluster of values while promoting change; balance the programs of the traditional university with those of a university with greatly expanded boundaries; encourage and promote strategic planning, marketing, investments in new technologies, in flexibility; persuade the educational community to transform itself while maintaining essential continuities with the past. And such a complex agenda cannot be undertaken without the participation of federal and state leaders, corporate executives, foundation officials.

I shall close where I began, several years ago, by glancing at some of the books available on the future of the university. The vast majority of those which dared to attempt sweeping, systematic analysis, were written in the fertile period of the late 1960s and early 1970s, Bok's volume a most notable exception. The titles form a complex and stimulating argument, in and of themselves: The Uncertain Future; New Colleges for New Students; The Fall of the American University; Whose Goals for American Higher Education? Scholars On Parade; The Degradation of the Academic Dogma; The Writing on the Wall; The Innovative Spirit; The Delinquent Academic Community. The more recent books are much fewer, highly specialized, less exciting; yet, their titles also reveal much about where we are, about our present concerns: The Economics of University Behavior; Higher Education in the Nation's Service; Challenges of Retrenchment; The State of the Nation and the Agenda for Higher Education; Research in the Age of the Steady-State University. I believe it is time for us to have another period of fertile, if occasionally misguided, thinking like that of fifteen and twenty years ago. We need more visionary ideas to enable us to plan a better future, to reinvigorate the university, to have the kinds of discussions we so often deny ourselves in our day-to-day work; in short, to dream new dreams.

THE FUTURE OF TECHNOLOGY IN LIBRARIES

By Richard W. Boss

The 1980s is a major period of transition in library technology, especially with regard to automated library systems. In the previous decade almost all of the local library systems implemented accommodated only single-functions. The most popular were circulation systems. Over 900 libraries in North America and some 100 libraries throughout the rest of the world purchased turnkey systems from vendors who supplied all hardware, software, installation, training, and ongoing hardware/software maintenance. Almost all of these systems operate on minicomputers. In addition, some 150 libraries purchased software packages for minis or mainframes. At least 1,500 libraries purchased software for a personal computer, usually in support of acquisitions or circulation control. Only a few score libraries sought to develop in-house systems. Despite the fact that library literature has been discussing the "integrated" or "total systems approach" since the 1960s, only a small minority of the systems installed during the 1970s are of this type. The 1980s, however, will be the decade of the "integrated system."

Functional Integration

The words "integrated" and "integration" are used in many ways: hardware integration, software integration, data integration. Each implies that the various components of the system work together to produce a unified result. In this paper, the emphasis is on "functional integration," where all functions share the central database, the same command structure, and the ability to access all other functions from one another. This means, for instance, that a person who logs onto the circulation module can perform bibliographic searches or other functions by direct commands without first logging off circulation and then logging onto another module.

Benefits of Integrated Systems

The designation "integrated system" refers to the system's design, not to what functions are actually being used at any one time. A software package may not yet be completed, or a library may choose to implement the applications over a period of time to enable staff to convert records, and to permit staff and patrons to adjust to the new system. In either case, the software may have an integrated design, though not yet fully implemented.

There are three principal benefits to a library which purchases a functionally integrated system:

- . lower cost;
- . improved maintenance of data; and
- . better service to patrons.

A fully integrated system in which all functions share a common database is usually less expensive than separately maintaining the functions same, either on a single or separate central processing units (CPUs), because there is less data redundancy and the total number of transactions supported by a CPU is greater than with a single function system. A CPU which supports only acquisitions, would support only a few tens-of-thousands of transactions a year even in a very large library. A circulation control system may support hundreds-of-thousands or millions of transactions. Combining acquisitions and circulation on an integrated system can usually be achieved for an incremental cost far lower than putting both on separate CPUs.

By having a single bibliographic database, not only is the cost of database creation and maintenance reduced, but the potential for the different databases getting out of synchronization with one another is eliminated.

The most important benefit of integrating systems is improved patron service. The patron access catalog will

display not only holdings, but also current availability. It will indicate when an item is out in circulation, at the bindery, still on order, or in the process of being cataloged.

The Elusive Objective

Despite the fact that the concept of integration was first discussed in the 1960s, it was actually achieved in few systems. At that time, the cost of full-size or mainframe computers (the only type then available) was too high for most libraries to purchase or develop a system to support multiple functions. The majority of libraries which automated had to use campus or municipal computer center facilities and staff. In this environment libraries had to compete with other institutional programs for scarce and expensive machine and human resources. Thus it is not surprising that most libraries automated only a single function.

While the advent of minicomputers in the 1970s allowed libraries to automate without having to purchase a multi-million dollar computer or competing for a share of the resources of the parent organization's computer center, the limited capacities of the early minicomputers which usually had fewer than 128,000 characters (128 kilobytes, or KB) of primary memory restricted libraries to automating a single function.

Often when libraries automated more than one function, they did so over many years. In many cases each function was treated as a separate entity, usually because the software for one or more functions was obtained from other libraries, thus making difficult the integration with functions already developed. Another reason was that software development mirrored the organization and staffing patterns of libraries--a serials system reflected the organization and files of the serials department and such a decision presupposes the appropriateness of the organization and staffing pattern upon which the system design is predicated.

Data integration was also achieved only gradually. In the sixties and early seventies it was common for staff in each functional area to insist that they needed different types of bibliographic records. The concept of a database built on a national bibliographic standard had not yet taken hold.

As late as 1983, systems were being developed which used different commands in each module. An operator could not retrieve an item by title from the acquisitions module using the same command as would retrieve the item by title from the circulation module. System developers described the system as integrated, but acknowledged that different design teams worked on the various modules.

Turnkey Systems

The high cost of custom development brought commercial firms into the picture. In 1973, Computer Library Systems Inc. (CLSI) of Boston began to market a minicomputer-based system for acquisitions control. Nine systems were installed, but the concept failed because libraries' acquisitions procedures varied too much to make it possible to use the simple standard software package that was offered. CLSI subsequently turned to circulation control and found much greater procedural commonality in this area. The initial installation of the circulation system was at the Marin County (California) Public Library in 1974. This system is still functioning today, although the software has been enhanced many times. By the late 1970s, CLSI had evolved into a vendor of "turnkey" systems, providing hardware, software, installation, training, and ongoing support from a single source. Over 250 CLSI circulation systems have been sold in the U.S., Canada, Australia, the Netherlands, and the United Kingdom. Some 50 of these have been expanded to include patron access catalog modules. By 1985 the turnkey library systems industry had grown to more than 20 vendors worldwide with sales of more than US\$100 million a year.

Minicomputer-based Systems

In the 1980s the capacities and operating speeds of minicomputers--the overwhelming hardware choice of vendors and libraries for local systems--have increased to rival those of the mainframe computers of the 1960s and early 1970s, but at a fraction of the cost. The typical minicomputer now being used for library automation can accommodate two million or more characters of primary memory or 16 times that of the mini of eight years ago. Superminis can be expanded to more than ten million characters of primary memory. It is possible, therefore, to support several functions--acquisitions, serials control, circulation, media booking, and patron access catalog--on a minicomputer and to have these functions share a single bibliographic database. Such a system is considered truly integrated.

There are currently no technical restraints on mounting several functions on a minicomputer. Theoretically, a new order could be keyed in as part of the acquisitions module, the item could be cataloged when received, serials check-in and routing could be controlled, an online patron access catalog could be created, and circulation could be accomplished using a single automated system.

Multi-user, Multi-tasking Micros

In the 1980s it became possible to mount multi-function integrated systems on large microcomputers--the multi-user, multi-tasking micros. This promised to bring integrated systems within reach of thousands of libraries. Despite the widespread enthusiasm for microcomputers there were few installed micro-based, integrated, multi-function automated library systems until 1985. Most of the hundreds of installed micro-based systems were configured around personal computers which support only a single user. They are not smaller versions of the larger machines, but rather are less sophisticated tools. An Apple or an IBM PC is not only limited to a

single user, but it can support only a single function using a limited database that would not be suitable for later use in a multi-function system.

Now that the hardware is available, the big issue is price. The hardware and software for a six terminal system might be sold for \$60,000, but the cost of selling the system, doing the profiling, and training the users adds at least another \$15,000 to \$20,000. That makes the price per terminal as much as \$13,330, up to 30 percent higher than for larger systems. When costs for these services are added to a three terminal system, the price of up to \$16,700 per terminal becomes unattractive to the majority of prospective customers. Yet smaller libraries do not want to give up these services. In fact, they often need them more than larger libraries. A major issue facing the industry is reducing the cost of providing labor intensive services and/or persuading libraries that these prices represent fair value. Failure to address the problem will result in vendors failing to tap a large potential market and many smaller libraries unable to automate. Thus, while integrated systems are now possible, we cannot yet be sure that they will be within reach of all sizes of libraries.

Something Missing

What is lacking in many of the fully integrated systems now available is a resource bibliographic database against which to match new title selections. Original cataloging and keying in records is expensive. It is desirable to rely on a bibliographic utility such as OCLC of the United States, UTLAS of Canada, or PICA of the Netherlands; or a stand-alone cataloging support system, such as MiniMARC or Bibliofile. The utility or stand-alone cataloging support system is the data bank from which records are drawn to build the local database. Once records are transferred to the local database, they can be used to write purchase orders, create an online

catalog, check-in serials, and establish circulation control records. This requires a linkage to a system which contains the resource database. So even in the case of the truly integrated system, it is unlikely that the system will completely stand-alone.

Interfacing Automated Systems

The first linkage to another system which most libraries seek is to a bibliographic utility or cataloging support system. Over 85 percent of the installed mini and supermini-based systems have such a linkage. When one system is linked to another because different functions are on separate machines or to accomplish the transfer of information between separate integrated systems, the systems are said to be "interfaced."

A library also may wish to interface its local library system with the automated acquisitions system of a jobber (book wholesaler) to take advantage of online ordering. Likewise, an interface may be required to a stand-alone system which offers more advanced capabilities than the integrated local library system in a particular functional area, e.g., a stand-alone serials control system. Most integrated systems either lack serials control, or have only rudimentary serials control modules. Another application is that of using the terminals of the local library system to access remote database services.

A library also may wish to have its system interface with the systems of other libraries in its geographic area for the purpose of resource sharing.

Homogeneous and Heterogeneous Systems

The other system to which the interface is sought may be one with nearly identical or "homogeneous" hardware and software supplied by the same vendor as a library has selected for

its own system, or it may be a "heterogeneous" system which has completely different hardware and software. Interfaces to heterogeneous systems--be they single or multi-function systems--are more difficult to achieve than linkages to homogeneous systems, not only because of the technical differences between the systems, but also because the vendors who supplied the systems involved may not be willing to cooperate in developing interfaces with competitive systems.

A library also may wish to interface with non-library systems on its campus, in its company, or in its municipal government. The most detailed examination of the potential for tying library systems to non-library systems was the report by Nina Matheson and John Cooper "Academic Information in the Academic Health Sciences Center: Roles for the Library in Information Management," Journal of Medical Education, 57:10, Part 2 (October, 1982).

Types of Interfaces

For a number of years, the only interface available was tape transfer. A magnetic tape produced from one system was loaded into another system. The Library of Congress facilitated this interface by developing the MARC (MACHine Readable Cataloging) format for bibliographic records in 1968. Even today there are systems which can accept MARC formatted records, but cannot retain or output them.

Tape transfer involves considerable delays. It usually takes hours to output or load a tape of several thousand records. There are set-up costs involved. Libraries which rely on tape interfaces usually schedule tape loading no more often than once a month. While some libraries find this an acceptable way of building their databases, it is not suitable for applications such as acquisitions, interlibrary loan, etc. Other types of interfaces therefore, have been actively pursued for the past several years.

There are three major types of non-tape interfaces.

- . Terminal-to-computer;
- . Computer-to-computer; and
- . OSI (Open System Interconnection).

Terminal-to-computer interfaces permit a terminal of one system to log onto another system to search its database, leave messages, or transfer information. The interface between a bibliographic utility and a local library system is the most common example of this type of interface. The terminal operator has to know the commands and procedures for using the other system. This can be a challenge when interfaces to several systems are maintained. The interface would be difficult for library patrons to use to search the holdings of several libraries.

Computer-to-computer interfaces involve computers actually being linked so that they can exchange information and enable a terminal on one of the systems to access the other system and perform all of the same activities as the terminals of that system in a manner transparent to the terminal operator.

In the case of a library wishing to connect an in-house system with the systems of bibliographic utilities, jobbers, or special-purpose single function systems, or two or more libraries trying to link turnkey systems from different vendors, we are seeking to interface or link several independently and fully developed systems. Such an effort involves interfacing computer systems with different hardware and different software using various programming languages, some of them proprietary and confidential. There also may be different file structures, operational features, command languages, record access methods, indexing methods, system performance priorities, etc. Most important of all, the

competing vendors may have little incentive to cooperate with one another.

Computer-to-computer interfaces require a great deal of programming, not only initially, but also each year thereafter because the linked systems are continuously being changed. In Fortune 500 companies, where these types of interfaces are common, they are usually undertaken by data processing personnel who control the development of all of the systems being linked. When a vendor undertakes such an interface it is usually with the expectation that several dozen of the linkages can be sold. For example, there are a number of commercially available interfaces for banking systems. It is unlikely, however, that interfaces will be commercially available to link systems which are not widely installed. Unfortunately, most vendors of automated library systems have few installations.

Despite the fact that computer-to-computer interfaces are difficult and costly to achieve, direct communication between or among heterogeneous library systems has the advantage of providing full access to and full control of all files, except as restrictions may be imposed for administrative reasons. For example, a library could update the patron records to reflect a delinquency on any of the interfaced computers. In addition to searching another library's holdings, a library could place a hold or perform an interlibrary loan charge-out transaction in another library's system.

As of 1987, the only common interfaces between heterogeneous automated library systems were terminal-to-computer interfaces. They involve the use of a terminal of one automated system to access the computer of another automated system. Dial-up access is something libraries can do without depending on vendors to find solutions.

It seems unlikely that vendors will place a high priority on developing interfaces with competitive integrated library systems. Rather than developing specific software to link heterogeneous systems, the likelihood is that the vendors will adopt protocols or standards which are general in nature. In order to facilitate the development of generic linkages among diverse machines, standards developers have been working toward the definition and delineation of all of the components necessary for communication among systems. The effort currently receiving the most attention is that of the Reference Model for Open Systems Interconnection (OSI).

Open System Interconnection (OSI)

The OSI protocols specify a set of standard rules and functions that computers must follow in order to exchange information. The protocols have been modularized into seven different layers. The lowest three layers are generally available as off-the-shelf interfacing products. The higher layers require special development for particular applications such as banking, insurance, libraries, etc.

The two bottom layers (physical and data-link control) deal with physical connections, recognition of messages, and connection reliability. These layers are specific for different types of networks. The three top layers (session, presentation, and application) handle connection management and the presentation and meaning of information to be exchanged. These layers are the same for all types of networks. Layer 3 deals with internetworking, and layer 4 resolves the differences between different physical networks and serves as the boundary between the technology-dependent, lower level data communications and the technology-independent upper layer data processing environments.

Library Applications

The OSI reference model has been widely adopted throughout the world. The Linked Systems Project (LSP) in the United States and the INET pilot program in Canada are to most ambitious efforts to date to use OSI for linking heterogeneous library systems. The LSP participants are the Library of Congress, OCLC, RLG, and WLN. The project began early in 1980 to support a shared authority file. The shared authority file will support the Name Authority File Service and help to overcome a barrier to effective exchange of bibliographic data caused by the frequent lack of heading consistency across systems.

While the recently completed communications link enables the participants' heterogeneous computer systems to exchange authority data, it will also facilitate the future development of sharing full catalog records, location and holdings data, transmitting interlibrary loan requests, communication with vendors, et al.

The link is based on existing and emerging international standards to the fullest extent possible. The American National Standards Institute (ANSI) is formulating higher-level standards consistent with OSI on the basis of the protocols developed by the Linked Systems Project. Work in progress includes the investigation of a mechanism for maintaining protocol parameter values, a file transfer protocol for library applications, and an intersystem interlibrary loan protocol.

The library automation industry has established an industry group called AVIAC (Automation Vendors Interface Advisory Committee) to stimulate standards development and to promote compliance with the standards by industry members.

The Open System Interconnection approach is likely to be adapted to the needs of libraries at least to connect systems at some distance from one another. For example, OCLC is actively moving toward an open telecommunications system. The first step will be establishing a CCITT X.25 standard interface between OCLC and other systems such as the LSP and the various value added networks: Telenet, Tymnet, Uninet, etc. OCLC's announced objectives are to provide greater flexibility in the choice of telecommunications options and to support linkages with other systems. One of the motivations appears to be to have the OCLC system function as a gateway to the various systems to which utility participants may wish to have access. The organization has the financial resources and an existing private data communications network to make the concept a reality.

Linking Local Systems

What is less certain is whether the OSI approach will be used to link local library systems together. While linking utilities or providing access to large resource databases is important, much of the demand for improved interfaces involves the linking of local library systems for resource sharing. If all local library systems in a metropolitan area were linked, it would be possible to determine holdings and current availability almost instantly. This would be a dramatic improvement over the interlibrary loan sub-system of a bibliographic utility which provides only holdings and takes an average of five days to return confirmation of availability. The big question mark is whether the price for the OSI linkages will be justified by the number of interlibrary loans. How many libraries with fewer than 2,000 interlibrary loans per year would be willing to make a \$50,000 hardware and software investment? The industry faces the challenge of bringing the hardware and software prices down to the point that interfacing systems at the local level becomes economically as well as technically feasible.

The Library's Role

Each library with an automated system or with plans for one, should designate one or more staff members to become and remain knowledgeable about interfacing standards and technology. RFPs (Requests for Proposals) should include sections setting forth the library's interfacing needs.

Even when vendors link two or more systems at the hardware and software levels, searching other systems may not be easy because a library or consortium which automates today usually decides to use full-MARC records, while many of the earlier installations have non-MARC records, thus complicating linkages. The arrangement of system files may vary considerably even though the same vendor's system is being used. In most situations it will, therefore, be necessary to develop common database standards before easy-to-use interfacing can be achieved.

Despite the obstacles, there is a reasonable prospect that OSI-based interfaces will be a reality by the end of the eighties.

Personal Micros As Workstations

Personal micros were dismissed earlier as not suitable for mounting multi-function, integrated systems. However, as workstations on an integrated system, they do have an important place in library automation. A workstation is a personal micro which can function both as a terminal and as a separate processor. Information retrieved using the personal micro as a terminal can subsequently be manipulated using word processing or other packages running on the micro's CPU.

Many libraries access local systems and remote databases using "dumb" (or ASCII) terminals which do not contain communications protocols. Because of the lack of communications protocols in the terminals, the only way a computer

being accessed by such a terminal knows which terminal is calling is by identifying the port or channel of the computer through which the terminal is coming. On the other hand, an "intelligent" terminal has communication protocols and can identify itself to the computer. This is important because telecommunications efficiencies can be realized using terminals that have built-in protocols. But these terminals are also more expensive. A personal micro can emulate or pretend to be either a dumb or intelligent terminal by loading suitable software.

With this flexible access device, users soon developed techniques which increased the efficiency of computer access. When accessing remote databases such as BRS, Dialog and SDC, users soon found that telecommunications costs could be reduced by preparing the initial search statement offline and going online to the remote system only for transmission. Similarly, when a satisfactory search result was obtained, the data would be downloaded from the screen into the micro's storage. After signing off from the remote system users could perform any further data manipulation to convert the results into a suitable format. Such techniques have been found to cut the cost of online communications and system usage by more than half.

Recognizing that this approach to database searching is becoming common, database vendors are examining their pricing structures with a view to moving from the established system of charging on a connect time basis to one based on the number of units of data being removed from the system, irrespective of whether that removal is by offline or online printing, or by downloading. Even if these pricing structures change to accommodate the new database access methods, users will still realize savings in telecommunications costs because the online connection is of shorter duration. The added benefit is that the end result is more malleable, and therefore more useful. The typical remote database service printout is not particu-

larly well formatted for the needs of the end user. However, when transferred to a micro and manipulated by a word processing software package, it becomes much more useful.

Three years ago, 10 percent of Dialog users were using a workstation approach. It is now estimated that, of the heavy users who collectively account for 80 percent of all Dialog use, two-thirds are using personal computers and downloading information rather than using dumb terminals.

OCLC's decision to adopt the IBM PC as a workstation to its system will accelerate the trend. Mead Data Central, the vendor of NEXIS and LEXIS, has abandoned its dedicated terminal approach (which required that these files could only be accessed using a terminal supplied by Mead Data) in favor of an IBM PC or any one of several other micros equipped with a special software package. Increasingly, database vendors of all types--Mead, OCLC, Dialog, ISI, etc.--are developing micro software packages to facilitate workstation access to their systems.

Turnkey automated library system vendors are also moving toward personal computers to provide data collection back-up for circulation, acquisitions, and serials control when the host computer system is down. If the host is down, staff can continue to enter data and record transactions on the memory of the PC being used as a workstation rather than in the memory of the main system. The same workstation can be used to perform other functions as well.

Libraries often overlook the administrative applications potential of personal micros, including word processing, accounting, and scheduling. Every library also has an office. A reduction in office workload by 35 percent or so is impressive, and there is no question that this can be done. The applications packages available for the office environment are superior to those for the library environment because the

users soon found that a much larger and more competitive environment. A word processing package may sell 200,000 copies and VisiCalc may sell 450,000 copies. Such levels of sales provide not only enough income to refine the product, but also a client expectation that the products should perform very well. Provided some care is taken in the selection process, it is possible to obtain very good spread sheet, word processing, accounting, and other software packages for almost any available microcomputer.

Post Processing

The PC-based workstation may provide the answer to libraries' needs for post-processing, which includes the ability to take the results of one search to formulate another search. An example of this is taking the journal citations retrieved in a Dialog search and matching them against the local database to determine which can be supplied from the library's own collection. Several development efforts were underway at the end of 1986.

OPTICAL MEDIA

A number of emerging technologies may be suitable for library applications. All of them claim greater storage capacity, faster information retrieval, support of multiple concurrent users, and lower costs than existing media such as microform and magnetic storage. The most publicized of the new technologies are the optical media: videodisc, compact disc, CD-ROM, and optical digital storage (on disk, tape, and cards). These technologies share "optical" characteristics in that encoding information on each medium relies on using optically sensitive materials; most also use light--generally in the form of lasers--for both recording and reading.

Characteristics of Optical Media

The materials and processes underlying each medium are remarkably similar, while the differences arise from the ways in which the media are being developed and marketed for

commercial applications. These applications are continually changing as companies which have expended billions of dollars in developing the technology continue to reshape their product lines in search of what has proven to be an elusive market.

By early 1987, four types of optical media were being promoted in North America: videodisc, compact audio disc, CD-ROM, and optical digital disk or optical mass memories.

Videodisc

The videodisc is a circular plastic platter, generally 12 inches in diameter, with a central spindle hole and an exposed shiny, rainbow-hued, mirror-like surface. Information is recorded as pits or bubbles on an optically-sensitive surface protected by a plastic overlay. Each pit or bubble is about one-fiftieth of the width of a human hair, allowing information to be recorded in very high densities.

The term "videodisc" is misleading insofar as it suggests that the disc is strictly a video medium, a technology displayed through a television receiver for entertainment or instructional purposes. The terminology is appropriate in that the distinguishing characteristic of the videodisc is that all information is recorded within the audio and video format of a standard television signal. The medium, however, is not limited to reproducing moving images and sound, as it will also accommodate still images and digital data.

Motion and still video, audio and digital data may be mixed on a single disc, or a disc may be devoted to only one data format. Applications which combine audio and video programming are the most firmly established, but programming that mixes audio, video, and digital data on a single disc is also becoming commonplace. As of mid-1985 it was still uncommon for a videodisc to be devoted entirely to digital

data. When used only for video storage, a single videodisc can accommodate 54,000 frames per side.

Of several competing types of videodisc, the reflective optical videodisc is dominant, and commercial support for other videodisc technologies has virtually disappeared. Although some services support the production of single or limited quantity discs, the dominant use of the videodisc technology is in applications which require mass replication of a disc.

In addition to offering linear, sequential playback of video and audio programming, videodisc systems offer a variety of other capabilities, including:

- . slow motion;
- . fast motion, in forward or reverse;
- . freeze frame, when the action is stopped at one among many frames of a motion sequence;
- . still frame, achieved through display of a single frame of text, art, or photograph, designed specifically for use in the still frame mode of play, or by displaying a series of identical frames of a single non-action image. The technical requirements for each type of still frame display differ with the formatting of true still frame material requiring special care in preparation of the program material; and
- . scan, in forward or reverse. In scan mode, a player skips over several tracks at a time, displaying only a fraction of the frames it passes. This mode is analogous to skimming through the pages of a book.

Besides normal play and scanning, many videodisc systems offer a third method of access: a search or random access function. Players supporting this feature have input keys on the machine itself or on a remote control keypad. Within seconds, users can accurately retrieve an image by entering the number of the required frame.

Videodisc Applications

The most successful application of the videodisc has been as a publishing and distribution medium for general purpose "entertainment" programs such as motion pictures, and as the vehicle for interactive programs for training, education, arcade games, public information and marketing.

A number of institutions with large pictorial archives, including the Library of Congress and the Smithsonian's National Air and Space Museum, are storing still and motion images on videodisc. However, the technology has not yet proved adaptable for routine recording and displaying of frames of still text such as pages of books and journal articles. This is in part because the standard television equipment used for videodisc systems is poorly suited to displaying text. A regular television screen has 250,000 pixels or dots of resolution. To be legible, the image of a printed page needs to be displayed on a screen with between 500,000 and 1 million pixels. High resolution television receivers which meet this requirement are available, but they are expensive.

The standard videodisc format is designed to handle video images at resolutions akin to those supported by regular receiver technology. Within these limits a standard television screen can legibly display only 1,200 or so characters --20 lines of approximately 60 characters per line. Thus, in most circumstances, the simple capture and storage of page images on videodisc formatted in accordance with North American television standards will not produce an acceptable display.

A number of companies have developed techniques for capturing and replicating machine-readable data on videodisc. Products aimed at the library market are at the vanguard of this application. Library Systems and Services Inc. has replicated the entire LC MARC database on two videodiscs to

support the MiniMARC cataloging support system. An annual subscription to the quarterly disc updates costs \$1,600.

Digitally Encoded Videodisc

There is considerable research in recording digital data on videodisc. Two methods are being pursued. In both, digital data is mastered and replicated in quantity runs using commercial videodisc production facilities and procedures.

The first approach, digital dumps, accommodates only limited amounts of data and is generally used to record player control instructions on interactive videodiscs designed for use with programmable videodisc players. A more recent development, premastering digital data on videotape, allows vast quantities of digital data to be recorded and replicated on videodisc. Any type of digital data may be "published" in this way, including machine-searchable ASCII coded alpha-numeric, bit-mapped image data, and digitized audio data.

The Lister Hill National Center for Biomedical Communications of the National Library of Medicine was a pioneer in developing techniques for recording large quantities of digital information on a videodisc and its playback on a regular industrial videodisc player. This work was eclipsed when a Massachusetts-based company, LaserData, developed a proprietary method of converting digital data into the analog codes used on videodisc. The LaserData technique is based on research undertaken at MIT.

Using this technique, a videodisc with a capacity of 54,000 frames per side can accommodate up to 1.2 billion characters (1.2 GB) of digital data. The actual amount of usable storage depends upon the error detection and correction techniques applied. Different techniques are promoted by the various companies now active in this field--LaserData, Reference Technology Inc. (RTI), TMS Inc., etc. Although the

procedures for publishing digital data in this format have been available for some time, applications are only now being brought to the market. It is not yet possible to assess the performance of such systems, but reports from MinimARC users in 1986 were encouraging.

Some problems are expected. Paramount among these is identifying and correcting errors. Mastering and replication procedures for videodisc production do not allow dynamic error identification and correction. There are many sources of errors in the production process, including errors in mastering and replication, and errors due to flaws in the materials used in disc production. Errors occur in the production of videodiscs for entertainment purposes. These errors, while often visible, are seldom obtrusive to the eye or ear. The sensitivity of machine-readable information to errors is much greater, since the loss or change of a single bit could cause a computer program to malfunction, or an index to return wrong information.

The future of the videodisc for text applications remains uncertain. There is little prospect within the next few years that libraries will be able to scan books, journals, photographs, and other materials with the intent of preserving the information on videodisc. The use of the videodisc for the storage of digital data appeared more firmly established, but likely to be challenged by CD ROM applications.

Compact Disc

The compact disc being promoted by the music industry shares many aspects of the technology used in the videodisc. The compact disc technology promoted by Philips and Sony uses optical laser recording techniques and optical playback systems similar to those developed for reflective optical

videodiscs. The compact disc is replicated using similar mastering and stamping techniques. A 4-3/4 inch one-sided compact audio disc provides one-hour of high quality stereo playback.

While conceptually similar, there is one major difference between a compact disc and a videodisc: the nature of the signal which is recorded. A videodisc stores information in an analog television format. All data--image, audio, or digital--has to be converted to this format during the premastering process. By contrast, a compact audio disc is geared to encoding audio data directly in digital form.

Like the videodisc technology, the compact disc is being promoted primarily as a mass replication technology. A master is produced and copies are stamped out on high speed equipment. In 1985, compact disc production facilities were available only in Germany and Japan, but in 1986, two U.S. facilities were opened.

Compact Disc Application

The only application of the compact disc is high quality audio reproduction. More than 35 percent of all classical music sales are now in the format. The technology is expected to displace phonodisc and cassette tape in another decade.

While any type of digital data may be mastered and replicated on a compact disc, including video and ASCII characters, the terms "compact disc" is almost exclusively used to refer to discs which carry digitized audio data. Almost all of the research into the technology involves consumer audio applications. By 1986, there appeared little prospect that the technology would be adapted to video or image storage.

CD-ROM

A separate technology--also using a small reflective optical disc--emerged in 1985: CD-ROM (compact disk read only memory). While it uses the same medium as compact disc technology, the initiative has come from the computer industry rather than from the recording industry. Development priorities and marketing approaches, therefore, are quite different. Even the spelling of the word "disc" changes to "disk" because the computer industry has gotten accustomed to "floppy disks." Although CD-ROM drives--the equivalent of the audio players--were not available in commercial quantities until 1986, there has been a great deal of interest in the library community. By year end, one-third of the AMIGOS members responding to a survey said they owned or were purchasing a CD-ROM device.

The CD-ROM is replicated from a master disk using techniques comparable to those used in producing videodiscs and compact discs. The capacity of a single CD-ROM is approximately 550 million characters (550 MB).

CD-ROM Applications

The major application of CD-ROM technology is as a read-only publishing format for machine-readable data. The small size of the medium and the disk player makes it particularly well suited to personal and desktop computers. The CD-ROM drive will actually fit into the same space as a floppy disk drive.

For electronic publishing applications, text can be recorded in digital form in two ways: (1) the image of a printed page can be digitized as a pattern of light and dark marks; or (2) the text can be encoded character-by-character in the standard digital representation of each alphabetic or numeric character. Applied to a standard typed page, the image scanning method results in the generation of some 32 KB of data. [Scanning of more densely packed printed pages requires high resolutions and consequently greater data

loads.] Recording the contents of the typed page by coding the individual characters in digital code would generate only 4 KB of information. A byte takes the same amount of storage regardless of the method by which it was generated.

In addition to being more compact, data input in coded form, one character at a time, also can be searched that way, such that a page of Business Week, for example, input as coded characters can be accessed by a keyword search. In this way, a search could be conducted for the words "optical" and "disk" when they occur in proximity to one another anywhere on a page. The search would retrieve that part of the text that contains these key words. Digitized page images cannot be searched in this way. However, there are applications in which a producer might choose to store data as page images rather than in character encoded form. Image scanning can be faster and less expensive than machine-coding; pictorial and other graphic information can be retained in image scanning; and, if undertaken at a sufficiently high resolution, the digitally scanned page can be reproduced as an exact facsimile of the original document on a printer or a high-resolution screen.

A number of electronic publishing projects were emerging in 1986, but only one was sufficiently established for evaluation: Bibliofile, The Library Corporation's cataloging support system. Bibliofile offers the LC MARC database encoded on three CD-ROM. A library provides the personal computer and purchases the CD-ROM drive, the personal computer interface, cabling, and applications software for \$2,900. An annual subscription to monthly deliveries of the cumulative database was \$1,500. Some 700 systems had been installed and appeared to be working satisfactorily.

Ongoing Research

As of 1986 developments in the use of CD-ROM appeared to be progressing far more rapidly than efforts to record digital

information on videodisc. One reason is that two of the companies that developed the compact disc technology--N.V. Philips and Sony--reached early agreement on formatting standards and have influenced the entire industry. A one-sided CD-ROM disk, which adheres to these standards has a storage capacity of 550 MB and can be played on any player from any manufacturer. In contrast, five incompatible videodisc technologies have been developed. The emphasis in CD-ROM research appeared to be on publishing machine-readable databases.

Optical Digital Disk

The fourth group of optical devices are generally known as optical digital disk or optical mass memories. While most commonly utilizing a disk format, there are also tape and card formats. The media share common technological foundations with videodisc, compact disc, and CD-ROM. The essential difference is again one of the targeted application and the consequent direction of commercial development.

Most work on the optical digital disk, the most popular format, has been directed toward the computer mass storage market. The intent is to develop a computer storage peripheral capable of augmenting traditional magnetic disks and, possibly, replacing magnetic tape media. Success in this market is dependent upon the storage medium being able to record data at the user site and being as easily written as read. This is in marked contrast to the direction of product developments for the videodisc, compact disc, and CD ROM--all of which emphasize mass replication and read-only applications. The optical digital media stress write-once-and-read-many (WORM) capabilities--also more recently called DRAW (direct-read-after-write).

Write-once and multiple-read characteristics make the optical digital media quite different from magnetic disk and tape. The magnetic media are erasable and thus provide both

multiple-write and multiple-read capabilities. While many companies are attempting to engineer erasability into optical digital media, as of early 1987 these attempts had not resulted in anything more tangible than prototype systems and tentative product announcements.

The greatest advantage of the optical digital technologies is storage capacity. Devices capable of storing 4 GB of data on one side of a 14 inch optical digital disk are now available. The actual capacity of the disk is greater, but between 20 and 50 percent of storage is typically devoted to data formatting, error detection and correction requirements.

Among the attractions of the media for computer mass storage applications are environmental considerations such as the relatively compact size of an optical storage system, the tolerant temperature and humidity requirements, and the lack of susceptibility of the medium to magnetic, electrical and other types of interference. As is the case in relation to the predominantly read-only optical media of videodisc and compact disc, discussion of the comparative advantages of optical digital media is clouded by the variety of different systems being developed. This is exacerbated by differences in the performance characteristics of laboratory and custom developed systems and those relatively few products which are currently available in the commercial market.

Optical Digital Storage Applications

Market penetration of the optical digital media has been disappointing. In North America, the media were slow to get established. It was only in the second half of 1984 that deliverable systems became a reality, at the end of 1986 most of the usage appeared to be experimental, and usage was far below the levels projected by most industry analysts.

However, at the end of the year two CLSI-Medline installations were brought up. A \$100,000 system configured around a Digital MicroVAX II can support up to six concurrent users of the full Medline database. While the price seems high, the opportunity to offer unlimited searching of the Medline database by end users is considered as well worth the price.

Ongoing Research

Optical digital storage research appears to be focused on developing large storage systems. There was not yet a basis for determining whether libraries would be able to make effective use of the media. Nevertheless, the large capacity of the media and the DRAW capability held out promise that this approach might be adaptable to in-house scanning and recording of printed text and graphics.

Future Prospects

A number of the optical technologies may have a future in libraries. In fact, some are already being used. Many public libraries have expanded their collections to encompass motion picture programming on videodisc and sound recordings on compact audio disc, while academic and special libraries are also being called upon to provide access to interactive videodisc programs for education and training.

At the next level of sophistication, the preservation and access opportunities that videodisc and compact disc offer for video and audio materials currently published in other formats were being explored in mid-1985. Examples of such usage of the technologies are relatively few: the National Air and Space Museum's videodisc collection of photographs of the history of aviation; the Library of Congress' compact disc of music performances from its collection; and the Library of Congress' videodisc transfer of motion picture footage previously available only as paper prints.

A number of companies are beginning to market machine-readable databases published on videodisc or CD-ROM to libraries. Most of these databases had previously been available only through large online computer systems--in-house systems or remote systems accessed through increasingly expensive telecommunications channels. The economics of the optical media, and their ability to give database producers direct access to users without the mediation of a database service, has provided even small database producers with a unique marketing opportunity. For example, The Library Corporation, a company with sales of only a few hundred thousand dollars a year, is marketing Bibliofile, a cataloging support system utilizing the complete Library of Congress MARC file on CD-ROM. The annual subscription rate for the monthly service is less than \$1,500, yet the company realized a slight profit after only 50 sales. It now has over 700. At least 50 database producers are actively pursuing the direct delivery of their databases to end users on digitally encoded videodisc or CD-ROM.

Videodisc will probably remain the most desirable medium for still and motion video through the eighties. Compact disc will probably dominate the audio market by the end of the decade. As yet, it is not clear whether any one of the optical media offer significant advantages over the others in mass replication applications for digital data such as the distribution of software, bibliographic data, and digitized full-text databases. Videodisc has an advantage when an application includes a mix of digital data and analog video or image data, and it currently offers a greater storage capacity than CD-ROM. CD-ROM offers simpler production techniques, and the promise of more widely available and less expensive retrieval equipment.

The least clear area is the use of the optical media for the preservation of images of printed text and graphics.

Although production costs are falling, it is not yet clear whether the relatively high initial mastering cost of the videodisc and CD-ROM will make it possible to use the technologies for applications in which only a few copies are required. The DRAW disk, which was beginning to become generally available in North America in 1986, may be the more suitable technology when a single copy or a limited number of copies are required. Using the DRAW process, only one disk is made at a time, unless several recording units are placed side by side and used simultaneously. Conceptually, there is no reason why DRAW disks cannot be replicated in quantity. Indeed, at least one manufacturer of write-once systems mentions this possibility in its product literature. However, in mid-1985 this capability was not being pursued by the industry.

The Conflict Between Preservation and Access

The emphasis in the development of all of the optical media has been on access, rather than on preservation, because that has been the expressed need of the major markets to which the technology has been directed. There is a conflict between the two. When access is the primary concern, information must usually be made available at multiple locations, more than one user should be able to access an item at the same time, and unrestricted access must be possible, rather than usage which requires special security precautions or the assistance of a trained staff. In contrast, preservation has two aspects: direct preservation of materials which are at risk in their original medium of publication; and indirect preservation by reducing daily wear and tear on the original materials by diverting a significant percentage of usage to reproductions stored on optical media. The materials chosen for preservation are often low-demand, rather than high demand items. The emphasis is on having them available for a long time, rather than for a large number of users.

All of the optical technologies can support both access and preservation applications. However, it is likely that they will initially be more successful in situations which emphasize access. This is because most of the technological focus has been on the media characteristics required to facilitate access: speed of retrieval, random accessibility of data, reduction of error rates, lowering replication costs, etc. In these access characteristics, the optical media have the potential to compete effectively with both paper and microform.

It appears that the preservation aspects of digital data publishing on optical media are less impressive than is the case with other uses of the technologies. While the media offer significantly greater durability and longevity than the other low cost digital storage media--floppy disks and magnetic tape--they have a significantly shorter life than paper and microform. Ten years is the maximum timespan for which any of the optical media are guaranteed. Improving archivability did not appear to be one of the high development priorities in 1986 because in most business and industrial applications the ten-year life of the medium represents a considerable advance over magnetic tape, and the optical digital disk can be routinely monitored and rewritten as required.

Libraries and archives are not likely to have a major impact on product development. The driving applications in which the disk is used as the storage medium--especially for digitized images--are likely to be in commercial organizations which have access as their primary motivation. The technology's ability to reduce large paper and microfiche files to a single compact form, readily and rapidly accessible from multiple local or remote workstations, is attractive to enterprises such as banks and insurance companies. Such organizations also appreciate the fact that systems based on the

optical technologies entail no manual refiling and do not involve one-at-a-time limitations on use.

Similar rationales also apply in library and archival settings. However, in these environments, there is a greater awareness of long-term preservation and storage considerations. These include the advantages outlined for the videodisc and CD-ROM publication of materials available in other formats: reduced handling of fragile originals and, in extreme circumstances, capture of the information and image content of materials which are disintegrating in their original format. The optical technologies are also attractive because of their potential to reduce the physical space requirements of very large libraries and archives.

A major factor in the suitability of the technologies for preservation and access is the relatively high initial cost for producing a master before service copies are replicated. To the extent that preservation involves the production of one or a limited number of copies, the unit costs may be high; to the extent that an emphasis on access may involve the production of many copies, the unit costs may be low. A republisher is, therefore, likely to choose those titles which are likely to sell hundreds or thousands of copies, rather than those which will sell 100 or fewer copies.

The publishing industry will probably adopt videodisc and CD-ROM for two kinds of publishing ventures: database publishing and republishing. Since both technologies require the creation of a master and replication by one of a handful of service bureaus, it is expected that the optimum quantities will be 1,000 to 5,000 copies. Nearly all of the existing or announced products are reference publications expected to get heavy use.

TELECOMMUNICATIONS

Increased use of automation and other technologies has been encouraged by the rapid cost reductions over the past decade. The implication of the trends we have been reviewing is that they will require much greater use of data communications facilities: the one area in which costs have been rising, especially in local areas. Libraries which have already begun to make effective use of multiplexors and other telecommunications hardware which allow several terminals to share a single voice-grade telephone lines have been examining a number of alternatives to the use of voice-grade telephone lines, including satellites, microwave, coaxial cable and fiber optics.

Telecommunications Prospects

The prospects are not bright in the foreseeable future. Satellites are economically viable only for long distance links--distances greater than 500 miles. Microwave--a technology which is normally deemed cost effective for distances of 25 to 500 miles requires substantial outlays for the sending and receiving equipment. Coaxial cable and fiber optics, both potentially cost effective at distances from 1,000 feet and up, can be implemented in a local area network without a license, but linking different parts of a community or a state requires licensing as a common carrier. Libraries therefore, are likely to purchase the telecommunications facilities from a local telephone company, special common carrier such as MCI, or a local cable TV company. While the market is expected to get more competitive, only very high volume users are expected to benefit from rate reductions in the next five years.

In the near term, libraries will have to project future telecommunications costs on the basis of present or even higher rates. To the extent that they can reduce online access by purchasing the information on digitally encoded

videodisc and optical digital disk, they may be able to control their costs to some degree.

Local Area Networks

Library users with offices located in the same building or building complex as the library will probably obtain remote access to the library system through a local area network (LAN). A LAN is a coaxial or fiber optic cable with voice, data, and, if of a type known as broadband, video transmission capability. By adding special communications intelligence to the network, an organization can use a LAN not only as a communications channel, but also as a way of electronically linking heterogeneous computer systems using the same OSI standards which are being developed for linking heterogeneous library systems which are at some distance from one another.

This technology is still somewhat expensive. It can cost from \$400 to \$1,000 per node to physically link devices and the development of the software for the higher levels of the linkages can cost tens-of-thousands of dollars. The most common approach today is to put an organization's major computers and a large number of personal micros on the network and to move information from one mini or mainframe to another by passing information through the micros and reformatting it. This involves only an investment in commercially available micro-mini and/or micro-mainframe downloading and uploading packages.

Metropolitan Area Networks

A number of the Bell Operating Companies (BOCs) are now developing metropolitan area value added networks that will facilitate data transmission and interfaces among heterogeneous systems. The digital switches in the network will permit data to be transferred at much higher rates than is possible over voice-grade telephone circuits. Special hard-

ware and software will support the lower levels of the OSI standards. Initial planning targets high volume users such as banks, but lower volume users such as libraries also may be able to use the service cost effectively. Most major metropolitan areas will have the service available by 1989.

Electronic Delivery of Hard Copy Information

Paperless society forecasts are common, but they overlook the fact that the bulk of any library's resources will continue to be in printed form for decades to come. The existing holdings of a library represent a tremendous investment. A library is rarely in a position to spend millions of dollars to reformat these resourced from print to machine-readable form. In addition, copyright holders may resist such reformatting. The publishing community is generally conservative with regard to technology. University Microfilms International, a major microform republisher, is experiencing considerable difficulty obtaining agreements from the 8,000 journal publishers it represents to have their publications made available to potential users in an electronic format. Since UMI is proposing to deal with the problems of the technology and the economics, UMI's conclusion that traditional publisher are still very concerned about losing control of copyrighted material in electronic form appears sound.

It may take several more years before a substantial percentage of the information libraries seek to collect is in machine-readable form. A scenario more plausible than a paperless, disembodied library, is one with a combination of hardcopy and electronic information. A health science library's collection typically grows at a rate of 5 percent per year. Were a health science library to commit half of its acquisitions budget to information in electronic form, it would have still have some three-quarters of its collection in hardcopy after two decades. It appears quite likely that at

least for the next 20 years libraries will have to be designed to accommodate books, journals, and readers. Libraries will also have to accommodate computer rooms, computer terminals, and a number of other electronic devices.

A major unpublished study of the impact of 14 technologies on academic library space planning funded by the State University System of Florida concluded that new technology would augment rather than displace printed materials through the 1990s.

As patrons become accustomed to the electronic transmission of information in machine-readable form, they may become more demanding with regard delivering material in hardcopy form. The technology which holds the greatest promise--at least for journal articles and excerpts from books--is digital telefacsimile.

Digital Telefacsimile

The new generation of telefacsimile equipment, high speed digital machines which permit the transmission of a page of copy in less than a minute, has gradually begun to enter libraries.

Several library telefacsimile networks have been launched in the past few years, including one among the law libraries of the New York City area and another among the health science libraries of Texas. The main application is transmitting journal articles. The average cost is just over \$5.00 per article--expensive when compared with first class mail, but a bargain when compared with overnight courier services.

That telefacsimile is undergoing a renaissance is evident from the sales figures. While there were only 255,000

machines installed in North America in 1980, 48,000 units were delivered in 1981, more than 100,000 in 1982, 150,000 in 1983, and 200,000 in 1985. This growth can be expected to continue as the 15 or so companies now in the market expand their product lines and are joined by new competitors.

The spread of this technology to libraries may be hampered by memories of the limited success of slower (4 to 6 minutes per page), older generation analog equipment of the 1960s. In response to some perceived reluctance on the part of librarians, a major foundation in the Pacific Northwest has recently committed more than \$100,000 to stimulate library adoption of the technology.

Electronic Mail

While a large number of libraries are now using electronic mail, there continues to be a communications problem because several different networks are in use. ALANET has signed up more libraries than any other, but ONTYME II actually transmits more library messages. At least four others are used by at least 50 libraries each. Fortunately, one of the newly developed standards under the OSI umbrella is X.400, a standard for interconnecting electronic mail systems. While the initial implementation of electronic mail in a library is usually on a PC in the administrative offices or in inter-library loan, the future prospect of having electronic mail available from any terminal or workstation on a local library system may make electronic mail as natural to use as a telephone.

CONSTRAINTS

It takes several years for that which is technologically feasible to become widely available. The factors which con-

strain the diffusion of a new technology include technological, economic, legal, and attitudinal forces.

For example, despite the fact that there are now a number of digital videodisc, optical digital disk, and CD-ROM based systems available--and a number of pilot products are on the market--the technologies are not yet widely used in libraries or elsewhere. This is in large part due to the fact that major production investments are awaiting the completion of relevant standards. Another technological constraint is the lack of reliable, high-speed optical character recognition devices for converting eye-readable information to digital form. The fact that there are fewer than ten disk pressing plants worldwide is also inhibiting development.

The fact that almost every product on the market requires a unique combination of drive, interface, and search software means that a purchaser cannot invest in a single system to use the products from a number of publishers. It would take an investment of at least \$100,000 to be able to search every optical product currently available.

Copyright is also a factor. Those who hold the copyright on printed materials are often reluctant to license electronic publication because they know little of the technology and fear that they will lose control over distribution and use.

Attitudinal factors include not only the attitudes of librarians, but also of users and potential publishers of information. Librarians fear that some categories of users will resist the new media as they have resisted microform in the past. Potential publishers often have a strong, even irrational commitment to the print medium. Those who do have prior experience with the marketing of machine-readable products fear a migration away from existing products. Manufacturers of the hardware tend to focus their efforts on the markets which appear to have the greatest potential. The library market is considered a minor one.

Because of the slow diffusion of new information technologies, it is necessary to plan new library services and facilities to encompass print, video, and electronic formats; and to provide for only a gradual augmentation and limited displacement of print by other media.

IMPLICATIONS

Libraries will continue to have collections of printed materials, but a significant percentage of the core reference collection will be accessed through computer terminals. Statistical, directory, and bibliographic information will become available in machine-readable form by the late 1980s. The electronic publications which need to be revised only a few times a year will probably be distributed on digitally encoded videodisc, CD-ROM or optical digital disk, with replacements sent by mail. The publications which need to be updated regularly will be distributed on optical digital disks which can be revised by downloading information from a remote resource database or by loading floppy disks provided by the supplier.

By the mid 1990s back files of journals, patents and other types of materials now often maintained on microform may be stored on optical media for faster retrieval--both within the library and remotely from elsewhere in the organization.

The library will provide information to remote users by local area network and possible through metropolitan area networks to homes and offices.

The implications of this scenario for the planning of library facilities is significant.

Space Planning

While it would be short-sighted to plan a library using hardcopy oriented planning formulae without modifi-

cation, it is premature to base plans on the concept of the "paperless" library. The vast majority of recorded information is available only in printed form: books, journals, government documents, maps, etc.

The facilities being planned now must accommodate all of these technologies because they will become viable during the useful life of any facility constructed during the latter half of this decade. A number of the information technologies affect design requirements. For example, library automation is no longer confined to the technical services area or the circulation desk; patron access terminals may have to be accommodated throughout the building. Any carrell could potentially include a personal micro or a terminal. The reference department may soon be receiving electronic publications on CD-ROM or digitally encoded videodiscs. Electronic document delivery may also be widely used. Libraries will probably have to accommodate micro-based workstations with peripheral mass storage devices containing large databases on most staff desks and at many user desks.

The response to these emerging requirements is to stress flexibility, but maximizing flexibility may significantly increase costs. Building for the future is a particular problem when the formulae by which space requirements and budgets are determined have not been adjusted to allow for the emerging technologies.

The widely adopted standard of 25 square feet per person has been recognized as inadequate when computer or audio-visual equipment is included in a carrell (an individual reading table with visual barriers). However, few formulae provide for more square footage. Only the formula of the California State Colleges and Universities provide for 35 square feet per carrell, but it limits the number of such carrells to ten percent of the total.

Most facilities which provide larger carrells for microform, micro-based work stations, audio-visual, personal computer, or other electronic equipment have had to reduce the total number of carrells so that a small percentage can be oversize. The prospect that electronic equipment will be widely used in the future makes it imperative that a formula of 35 square feet be adopted for all carrells throughout a facility so that at a work surface of at least 48 by 30 inches can be provided.

If it is not possible to install carrells suitable for electronic equipment throughout a library, provision should be made for a minimum percentage to be oversize. In light of the future potential of micro-based workstations and optical media the lowest acceptable percentage for an academic, school or special library is 25 percent. A public library should seek a minimum of 10 percent. All of the carrells in the reference area should be oversize, however, as should all units in microform and media areas.

Existing formulae recognize that staff in libraries work with materials and must have more space than regular office workers. A minimum of 150 square feet is well established, although some formulae provide as much as 225 square feet. With the advent of information technologies, larger desks are needed (30 by 72 inches) to accommodate not only screens and keyboards, but also optical drives and printers. A minimum of 175 square feet should be adopted.

Each staff desk should have a telephone outlet and a two socket 110 volt electrical outlet for computer printers, etc. A color-coded two socket 110 volt electrical outlet should be provided at each staff desk for a computer terminal or micro-based workstation and associated data storage. These outlets should not be on the same circuit as computer printers, or any other equipment which has a motor.

Because of the large amount of electronic equipment which libraries will have to accommodate in the future it is important that special care be taken to minimize static electricity. There should be no carpeting in the computer room. The floor should not require waxing. All carpeting in technical services and other staff areas should be anti-static, as should that in reference, microform, and media areas--the public areas which will have the greatest concentration of electronic equipment. All electronic equipment should be grounded. Anti-static chair mats which can be grounded should be used in front of other electronic equipment: digital telefacsimile machines, patron access catalog terminals in other areas of the facility, etc. Static build-up is more common when people are moving their feet.

All lighting throughout the facility should be indirect, recessed, or parabolic to reduce or eliminate glare on computer terminal or micro workstation screens, video screens, and microform reader screens. No desks or carrells should be positioned where direct sunlight can reflect off equipment screens. The emphasis in planning lighting should be on the quality of light, rather than the level of light. Any screen is easy to read in a lighted room if there is no glare. Special lighting for areas with electronic equipment, therefore, should be avoided.

Sprinkler systems are required in many jurisdictions. These present a threat to books and other library materials when they leak or go off accidentally, or as the result of vandalism. While it is now possible to salvage most water damaged printed materials using freeze drying techniques, water can cause irreparable damage to electronic equipment. It is highly desirable to specify that there be no water in the pipes and that the system be zoned. In such a dry-pipe system, water is released into the appropriate zone of the system only when a fire hazard has been detected.

Finally, the best preparation for facilities planning is for librarians to become and remain technology literate. This will require not only following the professional literature, but actively assessing products displayed at professional conferences.

Budgetary Implications

Information technologies are expensive. A properly configured multi-terminal automated library system costs at least \$10,000 per terminal to purchase and \$1,200 a year to maintain. A typical CD-ROM workstation costs as much as \$8,000. While digital telefacsimile machines now cost as little as \$2,000, they are costly to use because of the cost of telecommunication.

Information technologies will not reduce the cost of operating most libraries. At best automation contains rising costs by allowing more work to be done by the same number of staff members. Most libraries do not have enough people performing the same repetitive task to permit staff reductions or reallocations. Even libraries with more than 1 million circulations a year rarely recover more than two positions in that department. Only very large libraries are able to reduce acquisitions and serials staffs as the result of automation. In light of the major capital investment in hardware, software, and retrospective conversion; most libraries cannot recover the investment in less than seven years.

Despite the fact that library automation rarely saves money, it is cost effective because it significantly improve service to users. A patron at an online terminal of an integrated, multi-function system can determine not only what the library holds, but also what is currently available or on order. The number of access points is dramatically increased over a card or COM catalog. Key-word searching is a tremendous aid to those who are not familiar with standard

library subject headings. Remote dial-up access from outside the library can increase library use.

Optical media, digital telefacsimile, electronic mail, and other technologies also will help libraries serve users better, albeit it at somewhat higher cost.

Implication for Staff

Library staff are going to have to become "multi-literate," working with both print and electronic media. In order to use the technologies and serve patrons they will need to have additional training. Much of that training will occur after library school. While professional associations and some library schools will respond to the need, many libraries will find it necessary to introduce their own training programs.

Libraries implementing automated systems should plan at last three days of basic training and another two days of detailed training for each module which is to be implemented. Other technologies, including digital telefacsimile, electronic mail, etc. typically require only a half day each.

Part of any training program should be a discussion of the changing role of the librarian. As more and more library users undertake to use computer terminals, librarians will be called upon to perform more one-on-one training of users who have not mastered the technology. They will also be called upon more and more often to validate and interpret information as patrons' electronic searches turn up information from outside their own disciplines. A search of several databases on a topic such as water pollution will turn up materials prepared by engineers, biologists, doctors, lawyers, and economists. The varying terminologies and methodologies of experts in several disciplines will be very confusing to many library patrons.

As remote access becomes common, librarians will have to become skilled telephone and electronic mail communicators.

Thus, while consultation of printed materials and face-to-face contacts won't disappear, the role and expertise of librarians will broaden considerably.

Implications for Patrons

The optical media may make end-user searching very popular, but in order to take full advantage of the opportunity patrons will need to master new skills. Almost all patrons will need to have basic orientation, and if they wish to undertake more complex database searching, special training. Librarians are the most appropriate providers of such orientation and training. The potential demand goes well beyond that which most bibliographic instruction programs have envisioned.

While patrons may become somewhat more independent of librarians for much of their database searching, they will also become more dependent on them in many situations because they are likely to encounter the unfamiliar: a database which is new to them; the unique terminology of another discipline; an overwhelming amount of information which needs to be sifted down, etc.

However, the long-term implication for library patrons is much improved access to bibliographic resources, whether in the local library or in other collections.

EDUCATING RESEARCH LIBRARIANS FOR THE FUTURE

Evelyn H. Daniel

There are many changes in the college and university environment, many of which impact the education of academic librarians. I will discuss these and also comment on the growth of knowledge and the change in what society accepts as knowledge, with a few words about the information science challenge to the traditional library culture.

These two factors -- changes in the academic environment and changes in the perception of what is knowledge - suggest a need for a new approach to educating academic librarians. I will recommend a doctorate as the appropriate credential and justify it through philosophy, subject content, and research questions appropriate to a curriculum for academic research librarians.

Changing Information Requirements of Campus Groups

The first section of this paper might be called "Changing Information Requirements of Campus Groups." Five salient aspects of the changing university environment will be discussed. I will identify some changing characteristics of the three major campus groups -- the students, the faculty, and the administrative staff. I will also note some of the organizational problems of the library and the computing center with attention to their similarities.

The Changing University Environment. Universities today pride themselves on their businesslike practices. Fiscal management is professional, physical plant operations efficient. Strategic planning is encouraged. New programs are

regarded as "ventures" and "investment options". Old programs are subjected to cost-benefit analysis to determine their continued viability. Marketing absorbs much time and attention. Faculty are perceived as producers of research and teaching while students become consumers. A business orientation fosters greater concern with control. The scholar administrator has given way to the executive manager.

Second, the size and diversity of resource investment decisions has escalated. There are no small options. Laboratories, equipment and instrumentation; new construction, renovation and maintenance; automated systems; 'star' faculty with their research entourage; research collection needs; telecommunications networking and information technology are but a few of the opportunities for investment -- all with a high threshold for entry. The comfortable old policies of incrementalism and gradualism do not apply. Tradeoffs are necessary but unpalatable, for example, student aid vs. new equipment, salary raises vs. "star" faculty, a new chemistry lab vs. a remedial support program.

The university is less cloistered today. Its boundaries are open to outside influences to a remarkable extent. Federal and state legislative decision have always affected the university. Today large commercial vendors also seek to influence campus decisions. as do major donors. Gifts that require co-investment or gifts that lay constraints on the university's future actions create problems. The need to interconnect with other universities and other agencies through consortia, contracts, and competitive agreements also diminishes the university's autonomy.

The fourth factor exerting a profound effect on the university environment is the growth of knowledge. The greater fragmentation of academic disciplines

makes it more difficult to synthesize what is known. The distance between specialties makes it hard to identify relevant information from fields other than those closely associated with a sub-field. Knowledge grows at a differential rate.

Once popular fields become backwaters. New areas expand explosively. The university must consider whether the information infrastructure developed so long ago to collect and make available the products of the growth of knowledge is sufficient and complex enough to meet present requirements.

The invasion of information technology with all its potential rewards and present problems completes my five points on the changing university environment. New tools for learning, new information sources, new work habits are the subjects of experimentation. The campus of the future will be reshaped by the challenges and opportunities of the new technology. The role of the new technology is one of the most discussed items on campuses today. Investment options are costly, yet delay may be more costly.

To this list of five pervasive influences on the changing university environment -- the business orientation, the immensity of resource needs, the openness to outside influences, the growth of knowledge, and pending technological changes -- you may wish to append others.

In the next section, I wish to consider what some of these effects have been -- on students, on the faculty, and on the emergent class of administrative knowledge workers.

Changes in Campus Group

Students. Between 1960 and 1985, college and university enrollments mushroomed from 3.9 million to 12.2 million. Thus, throughout much of this

period, massive growth has been a way of life. In the last 5 years, however, the enrollment has remained relatively constant.

Much of the increase in enrollment comes from people who differ in gender, social origin, high school preparation and time commitment to education. Fully two-thirds of student enrollment today consists of part-time students. Twenty-five years ago, fewer than 20% were part-time. In addition, a new class of students of limited economic and cultural attainments are attending institutions of higher learning. There is a higher proportion of poorly prepared students.

An unprecedented shift in enrollments has taken place. The strongly professional or practical fields have gained enrollments -- architecture, business, computer science, engineering, the health professions, law. The humanistic fields and some of the social sciences have lost enrollments -- education, english, history, mathematics, political science, sociology. Those breaking even appear to straddle professional and humanistic areas -- fine and applied arts, life science, economics, the physical sciences, psychology. It has been difficult for institutions to shift resources rapidly enough to accommodate these changes.

Faculty. Faculty have also changed, although less so than students. Most still derive from the middle class. A significantly greater number of faculty concentrate in the upper ranks; the percentage of tenured faculty in the past 20 years has doubled (although there are few women at senior ranks and a lower percentage of women on tenure). Minority faculty, always few, are losing ground. A sub-group of increasing size and visibility is the part-time faculty who presently represent nearly a third of the total faculty (from 80,000 in 1960 to

over 220,000 today).¹

An old list of generally acceptable qualifications for faculty included such things as high general intelligence (in the upper 5-10% of the general population), keen interest and mastery of a special field, self-motivation, rapport with students, intellectual curiosity, open mindedness and tolerance, breadth of intellectual and cultural interests, and a contemplative disposition. Are these characteristics changing? Probably. "Mastery" of a field is increasingly difficult. Rapport with students appears less valued than research productivity. We know that a faculty's tolerant attitude can disappear rapidly when threatened, and finally, the problem of "keeping up" may diminish the breadth of intellectual and cultural interests. There is little time for contemplation.

The faculty are fragmented. They are increasingly segmented -- by rank (juniors don't mingle, not with seniors and not with each other), by discipline (a small community of scholars off campus may be closer than university colleagues), by salary status (the haves and the have nots correlate to the "hot" areas and the rejected or marginal fields), by physical distance (separate buildings, separate campus areas, little natural opportunity to come together), by conflicting and pressing work demands (advising, research, cultivation of sponsors, negotiation with proliferating administrative bodies). Faculty governance has deteriorated, as has faculty dominance of the university.

As the university shifts to a businesslike, investment-weighting orientation, and looks at groups of faculty as "sunk costs", faculty retaliate by shifting their loyalties from the immediate university campus to their disciplines, their

¹Howard R. Bowen and Jack H. Schuster. American Professors; A National Resource Imperiled. (New York: Oxford University Press, 1986).

outside life and their personal investment concerns. The open boundary of the university allows faculty to experiment with life in the corporate and the government milieu, sometimes loosening their ties altogether. Faculty entrepreneurs may reflect the entrepreneurial cast of the university.

The problems of coping with the growth of knowledge need attention. Faculty's current mechanisms for coping appear strained and inadequate. The use of information technology as a potential solution to some of these problems appears promising, but the present approach to the design of the scholar's workstation seems more technical than conceptual. Attention must be directed to the human problems involved in changing work habits and incorporating new tools.

Another frustration of faculty life today involves the burgeoning class of administrative knowledge workers. This group was created in part to relieve the faculty of some of the burdens of running the university which they may have done too well. They now act as a controlling force, a fact that faculty often find deadening and overly bureaucratic. It is to this class we now turn.

Administrative Knowledge Workers. Although, one can document the loss of support for faculty, secretarial and laboratory service and for student assistants to aid faculty, it appears that, nevertheless, there has been significant growth and differentiation in staff personnel. These knowledge workers or information processors are (have been) early targets for replacement by automated processes. However, the political milieu surrounding them and the difficulty of assessing the real value of their outputs in real terms may protect them from significant losses.

Administrative personnel are becoming professionalized, a process which tends to diminish local loyalty and to create additional demands for resources,

constituency. Faculty and students belong to departments, as do administrative workers. In a zero-sum situation, it has often been difficult to marshal support for major technological investment in these support units if it appears to put the high priority departmental needs at risk.

Both units are similar also in that neither can be self-sufficient. Strong linkages internally to branch libraries and departmental computer centers and externally to parallel units in other universities result in rising inter-dependencies. Greater connectivity is necessary, but also requires greater attention to coordinative mechanisms.

Structural changes are being considered that will bring the library and computer center closer together. Some greater integration of services seems inevitable but probably will not be accomplished without strain.

The question arises, if the University were to be created today, how would it be different? Would the library be separated from the computer center? Would faculty be organized in disciplines? Would there be a formal faculty? Would there be a separate administrative class of workers? Would there be librarians? What kind of information support units might there be? Would students travel to campus? Would they live in residence halls? Would we have the same degree structures and rites of passage we now have? Would research and teaching be separated? Would there be tenure? What kind of governance structures would there be? Who would make decisions?

Thinking about these questions may help us decide what the nature of the campus of the future will be and how we as librarians/information managers will fit in.²

²Evelyn H. Daniel, "An Examination of Faculty and Administrative Knowledge Workers and Their Major Information Support Units," pp. 35-58 of Campus of the Future; Conference on Information Resources. (Dublin, Ohio: OCLC, 1986).

but provides a higher level of service. Professionalism also moves this group closer to the faculty in world view and in adoption of scholarly attitudes and use of resources.

Internal databases created for purposes of administrative control also have potential uses by faculty in a number of ways. Ownership of these databases will not easily be resolved and may require the mediation of the information support groups (although computing is itself often divided between the administrative and academic).

Librarians share problems with both the faculty and the administrative knowledge workers. They perform a daily balancing act between them. I turn now to the major campus information support services.

Information Support Services. The computing center and the library share a similar mission -- to connect faculty and students with sources of information. Both organizations are experiencing serious strains at the user interface, where there is a considerable demand for assistance and instruction. In part, this is the result of the increase in numbers of those served and in part, it is due to the increase in the quantity and intensity of services being used. Users are becoming more sophisticated and more demanding.

Both organizations are experiencing increasing costs of operation as they strive to provide traditional services in traditional ways, while at the same time they attempt to put into place new kinds of operations and new ways of providing the traditional services. It seems reasonable to conclude, that as a corollary to the growth of knowledge, there needs to be a concomitant growth in the size and complexity of the information support infrastructure.

Both organizations are similar also in that neither has a natural

The Growth of Knowledge and Changing Social Attitudes to Knowledge

Things change slowly. The university and its library are both conserving organizations with a primary role of preserving knowledge and making it available to new generations. The university creates new knowledge but the links to the past are strong. Our traditions say that new knowledge arises from the old. New findings are reported in a bed of citations from older works.

This conserving, maintaining stance is not one that takes easily to change of any kind. Rapid change in the environment requires a more fluid organization, and, a more decentralized one, one where professionals have greater authority and autonomy to make rapid decisions, one where governance is by policy instead of dictates or consensus. There are structural weaknesses in the university and in the academic libraries that serve them. Knowledge is increasingly fragmented across the campus. Many new information support units have arisen in response to particular needs. These are often not linked to the library.

Machlup classified knowledge into five different categories -- practical, intellectual, spiritual, pastime, and unwanted knowledge.³ Libraries have usually focused on intellectual knowledge as the proper sphere of their activities. Today, there may be as great a need for practical knowledge, that is, the instrumental information used in everyday life. The more technological a society, the greater its need for practical knowledge.⁴ Fran Miksa has written

³Fritz Machlup. The Production and Distribution of Knowledge in the United States. (Princeton: Princeton University Press, 1962), pp. 21-27.

⁴Francis L. Miksa, "Machlup's Categories of Knowledge as a Framework for Viewing Library and Information Science History." Journal of Library History, Philosophy of Comparative Librarianship, 20 (Spring 1985), 157-172.

about the need for libraries to focus more directly on collecting and organizing practical knowledge. Practical knowledge perhaps what we mean by the term "information", is growing more rapidly than any other kind of knowledge in Machlup's classification. The scientists and engineers on our campuses have the greatest need for this instrumental kind of knowledge and are probably the least well served by the library. Administrative knowledge workers also often need knowledge of a practical kind.

Librarians have performed an important social role in collecting, organizing, preserving and making accessible the intellectual records of the human race. Society has valued it, perhaps more in the past when such knowledge was a scarcer commodity, than now. Still the collection of intellectual knowledge is still perceived as an important function even by those who never use libraries because of the "spillover" benefits that arise from another person's use of the library.

Spiritual knowledge is represented through religious writings and philosophy. Today, there is a growing concern with ethical and moral issues. This need is not for factual information but interpretation. Reading with discussion is a good mode for comprehending this kind of knowledge. Pastime knowledge is often associated with the public library and the provision of materials for entertainment and aesthetic enjoyment. Of course, as Jesse Shera pointed out many years ago, "What is one person's pastime, is another person's practical, instrumental, or intellectual knowledge."⁵ In other words, the classification of knowledge or information from the user's perspective is a dynamic phenomenon and shifts over time.

⁵Jesse H. Shera. Sociological Foundations of Librarianship. (Bombay, India: Asia Publishing House, 1970), p. 105.

I will return to the difficulty of differentiating knowledge and information. Machlup makes no distinction between the two. In fact, his last category, unwanted knowledge, might include television commercials, boring lectures, manuals of instruction that tell you everything but what you want to know, and all the written and spoken messages that come unsolicited everyday. The "information overload" phenomenon is a manifestation of unwanted knowledge. About 50 years ago, the Spanish philosopher, Ortega y Gasset, railed against the torrent of new knowledge and urged librarians to act as filters or gatekeepers to "stem the tide."⁶ There are new positions for information workers today who act as filters. They are expected to master an area of knowledge perceived to have value so that when an information need arises they can provide a precise answer, filtering out all the unwanted knowledge. Information compression, synthesis, and hierarchically ordered knowledge - all filtering techniques - form the basis of today's expert systems.

The New Information Paradigm. Information science has been gradually making serious inroads into the tranquil world of library education. Few schools have totally integrated librarianship and information science. The new information paradigm proposes that as information managers, our central function is to collect, store, organize, and maintain information. Information is defined very broadly to include data, facts, theories, and opinion. Information is also seen as a commodity, something of value that is tangible and can be exchanged as other commercial products are exchanged. A subfield, called Economics of Information, studies some unique characteristics of information as a resource that make it

⁶Jose Ortega y Gasset, "The Mission of the Librarian." Antioch Review, 21 (Spring 1961), 133-154.

unlike other resources.

Librarians who have heretofore perceived themselves as educators, counsellors, and conservationists are now asked to see themselves as information providers and information managers. I believe these roles are compatible. They are not substitutive, as some informationists would seem to be proposing. Still, a change in thinking about our field seems required. A new information culture is forming.

In academia today, there is a continually accelerating growth in practical and intellectual knowledge. There are technological tools now available that permit us to capture information about information and to organize it in new ways. I perceive that there are similarities between the goals and organization of the computing center and those of the library so that some efficiencies might obtain in a closer partnership. However, efficiency in doing what each has always done is not enough. There is a growing need for a new set of expanded information services.

Julie Neway argues persuasively that librarians should serve as members of research teams - extending our "reference" services out into the community.⁷ We also need to apply our energies to the design and development of expert systems and information databases. There is a future role in providing integrated and interpreted access to expert systems similarly to our patterns of intellectual access provision for books, periodicals, online databases, media and other artifacts. Malcolm Getz envisions an online catalog accessed via a menu with the following choices: first, a book-oriented inventory and catalog system; second, access to article-level indices perhaps on video disk; third, access to full-text

⁷Julie Neway. Information Specialist as Team Player in the Research Process. (Westport, CT: Greenwood Press, 1985).

electronic documents with hypertext capabilities; fourth, access to numeric data with tools for data manipulation; fifth, an electronic mail environment for the campus and beyond; and last, a gateway to external databases not maintained at the university.⁸ None of these choices is impossible today.

Yet, there are problems. Resource needs may seem to be the obvious problem but I believe it is a policy problem. Resources are always scarce, yet very large ventures do get funded. This usually happens through a political process. The problem, as I see, is that academic librarians are not, as a general rule, included in shaping policy at the highest levels of the campus. A recent ARL Office of Management Studies report on how telecommunication information policy is determined in universities, is tellingly entitled, "Academic Libraries on the Periphery."⁹ Key findings of the report were that libraries were not a sphere of authority in the formulation of telecommunication information policy, that library involvement in policy formation committees was limited, and that the relationship between libraries and computing centers could best be characterized as focused on present practical needs, rather than future possibilities.

A second problem possibly caused by the lack of library involvement in policy development is that there is no realization in the university of the fact that the prodigious and continuing growth of knowledge must require a prodigious and continuing investment in the information infrastructure. Resources allocated to meet present needs are woefully inadequate. As a result, it is difficult for libraries to free themselves from operational fire-fighting to engage in policy-

⁸"Meeting the Needs of the Electronic Scholar," The EDUTECH Report 2 (February 1987), 4.

⁹Flower, Kenneth E. Academic Librarians on the Periphery: How Telecommunication Information Policy is Determined in Universities. (Washington, DC: Office of Management Studies, Association of Research Libraries, 1986).

making councils, to diagnose new information needs and to recommend and design new services to meet these needs.

The kind of studying, planning and alternative weighing that academic librarians (all of them not just the directors) need to do is exemplified by some of the research questions posed in the 1985 annual report from the Council of Research Libraries.¹⁰ For example:

How does the manner in which information is organized, stored, and presented affect its utility?

Do large files of machine-readable information and new processing capabilities affect the substance as well as the methods of research?

How can we assess the quality of information and information service?

How do information needs vary by discipline?

What is the future role of libraries, in relationship to teaching?

How should universities manage information systems and services?

What are the impacts of multi-institutional operations?

How should we attend to issues of privacy, revised definitions of intellectual property, database reliability, security, dependence on commercial data services, etc.?

Jim Haas, the Director of CLR says, "The task for libraries is to do better what they have always been charged with doing. ... We have to learn to cope with complexity, ... The perception and definition of what a research library is and how it works must change -- it must change in the minds not only of librarians but of faculty and university officers as well." He goes on to say, "We are convinced that too little is known about the ways that the information pertinent

¹⁰Council on Library Resources, Inc. Twenty-Ninth Annual Report, 1985. (Washington, DC: Council on Library Resources, Inc., 1985).

to scholarship and research is generated, made accessible, and used."¹¹

This statement, made in October of this year, suggests an urgency that I found reflected in the comments of seven first-rank ARL directors and foundation heads at an invitational conference held at Wye Plantation last November. There is agreement among these top leaders that the task is one of managing change and in providing leadership on the campus in developing information policies that are intellectually, socially, and economically appropriate.

The Education of Academic Research Librarians

Change does happen. Educated people believe in the power of education to change the world. As an educated person and an educator, I share that view. It is slow. It is hard to predict the future for which we are preparing people. Yet, we believe that education has the power to change for the better. We think we see evidence of this as we look within our own culture and compare those who are educated to those who are not.

In my opinion, academic librarians need a higher level of educational preparation. The Master's degree has served well for a long period of time but is now inadequate to the present challenge and insufficient for the environment in which academic librarians work. My reasons are as follows.

First, the kinds of responsibilities librarians will have, and the kinds of policy issues they should be involved in, will require a deeper and more research oriented education than can be offered by a one-year or even a two-year Master's degree. We will continue to need subject specialists. One who holds a doctorate in a discipline area can be adequately educated for library work via a Master's

¹¹James Haas. "[Preface to] Invitation Conference on Professional Education, Wye Plantation, Wye, Md., November 9-11, 1985." (Washington, DC: Council on Library Resources, Inc., 1985).

degree program. However, we also need specialists in our own field of information, which is increasingly taking on the dimensions of a discipline. For example, I believe with Jeremy Campbell and others that there are three fundamental substances of life: matter, energy and information.¹² We have created disciplines around matter and energy and used a scientific method to probe the nature of these two phenomena. We are beginning to do this with information which has properties as interesting as those discovered for matter and energy. The tools of the scientific methods do not fit as comfortably to the study of information, a shape-shifting, essentially human phenomenon. We start with these, however.

We have a good research base today. Our faculty are knowledgeable in an array of research designs and methodologies and have, for the most part, established good lines of independent research. Our field seeks answers to some basic questions on information use by the individual and by the organization. We are less concerned (as we have been in the past) with mission-oriented and descriptive studies that are not directed by well-reasoned hypotheses arising from a theoretical base. We now have well-established paradigms for creating new knowledge that will begin to answer some fundamental questions such as those posed by CLR. We have taken some steps toward understanding information policy, essential if we are to engage fruitfully on policy issues.

My second reason for proposing that the doctorate become the standard terminal degree for academic librarians is that a stronger focus on basic research issues may free us from the strong traditional and bureaucratic constraints under which we too often practice. The Master's degree librarian is

¹²Jeremy Campbell. Grammatical Man; Information, Entropy - Language and Life. (New York: Touchstone Books, 1983).

often socialized to understand the way things are and to accept prescribed patterns of behavior based on past circumstances. A doctoral education is different. The attitude of mind is questioning rather than accepting. There is an urge to experiment under controlled conditions, to test assumptions, to engage in speculative discussion. This kind of education might help us to re-discover that information is our concern and not its package or container. We knew this once, but sometimes we forget in our concern for managing our physical resources. We also might re-discover that it is the flow of information within our client communities that is our true concern and not simply the building and collections we call the library.

It is the intellectual conception of the library that is what matters and not its physical manifestation. Maurice Line in 1968 when said, "We [librarians] should be in the thick of all discussion about information and communication -- if possible, we should initiate them. This may mean the death of libraries as we know them -- but if we want to keep libraries as we know them, it may be the death of us."¹³

The need to understand information and knowledge is enormous. To communicate and control the vast and complex activities humans undertake, and to communicate and control the vast record of knowledge, requires the design of large scale information systems parallel in their complexity. It is not surprising that information studies is emerging as an important study area with a fundamentally interdisciplinary, or multi-disciplinary basis.¹⁴ For example, we

¹³Quoted in Allen B. Veanor, "1985 to 1995: The Next Decade in Academic Librarianship, Part II." College and Research Libraries 46 (July 1985), 305.

¹⁴William J. Paisley. "Information Science; a Multi-Discipline." Presentation for the Association of Information Science Education, Chicago, January 14, 1987.

share with psychology an interest in discovering the cognitive basis for how people process information. We are interested in memory and the brain's associative networks in order to design appropriate access and organizing systems. We are interested in information use in decision-making -- the timing and the changing information requirements humans have as they move through the process of making a decision. Questions that intrigue us include, what is the balance between rationality and irrationality in making decisions? At what points are people open to active search or to passive receipt of new information? When are they closed? When do they seek new possibilities, new alternatives? When do they need facts? When speculations? What serves as confirming evidence? What is 'truth'?

The last question puts us in the philosophy camp, which Curtis Wright, for one, claims is the appropriate intellectual background for the practice of librarianship.¹⁵ We share with sociology an interest in the behavior of large organizations. The impact of structure on information flow is a problem that holds interest for me. How do organizations change? How are innovations diffused? How is information diffused? What information passes between the boundaries of one organization and that of another? Surely these questions are central to policy-making for information use on campus.

We are interested in the impact of technology on job structure. There is an inevitable blurring of boundaries between and among departments as technology shifts the direction and nature of information transfer. Libraries are interesting organizations to study, as are computing centers. This is especially true now as both undergo massive and rapid invasion of technology in all the

¹⁵H. Curtis Wright, "From Chaos to Kaplan," Presentation at the University of North Carolina, School of Library Science, April 1986.

fundamental tasks they perform.

We are interested in the increased possibilities of new product/service creation through information technology. How do these new information products and new information services affect the work of the faculty? Of the administrators? What is the new "information industry"? We share with economics an interest in the study of these new sectors in our society and the changing pattern of the world's laborforce.

As we become more aware of the need for information policy and direction in determining new patterns of interconnectivity, we share an interest with political science in studying the stakeholders and the shifts in power and influence on the college campus as a result of a new technological base of power.

We are a social science, although our interests overlap those of computer science, physics and engineering. We must balance our newfound technological interests with our continuing and enduring link to the humanities.

I could go on. The point is that there is new knowledge in our field and new problems to study. Our curriculum has become more academic -- less how to catalog a book and more what are the ways of organizing a body of knowledge for a particular purpose. We teach less the examination of particular reference tools and more what strategies people pursue in searching for particular kinds of information. Our curriculum is larger. It includes courses on information technology, the psychology of users, the economics of information. We know that our practitioner/graduates will be managers and we are expanding the management portion of our curriculum with courses in personnel management, financial resources management, organizations and organizational behavior. We have taken a more questioning approach to our subjects and added new tools for exploring these questions -- systems analysis, statistics, both quantitative and qualitative

research methods, etc.

The Academic Librarian. To return to the academic library setting, I believe roles within that setting are changing radically as the technology invades more pervasively and as the external environment changes and makes new demands. There will be a merger of libraries and computing centers at some point, I have no doubt. Each complements the other. With the present situation, there is much duplication and for the user, too much uncertainty about where to go for what kind of information.

Tasks that can be systematized will be automated. There will be a higher proportion of non-professionals and pre-professionals to professionals. Some predict a ratio as high as 5:1. These changes will mean that the professional librarian will be a manager and a policy-maker. He/she will be more involved in strategic planning and decision-making and with the design of new products and services. There is an increasing call for leadership, a scarce commodity at the best of times. There is a need for librarian involvement in policy development on campus. We need library/information managers who will question and who will enlarge the theory and practice of the field.

The shift in role to one more external than internal to the library organization will require a much closer working relationship with other faculty and administration. To maintain credibility and to have suggestions adopted will require a credential that matches that held by those in power on the campus. The common denominator is the doctorate. No amount of master's degrees will serve as an acceptable substitute. Those faculty who hold the doctorate keenly remember the long and arduous education they underwent to gain admission to the academic community and they esteem highly the substantive work they do to maintain their

position. Consciously or unconsciously, they hold in lower status those who lack the doctorate.

We now have Ph.D. subject specialists in our libraries and a few Ph.D. information specialists. All the professional staff will need the doctorate in the future for the two reasons I have tried to present in this paper:

1) The amount and sophistication of the knowledge base in the field requires a doctorate for mastery.

2) The importance of the peer credential for admission to peer academic status is a necessary condition.

Let me conclude with a quotation. It is from Eldred Smith written some 15 years ago. He said, "An academic's perfectly proper jealousy does not make it easy for others, who may have somewhat different qualifications and functions, to become full-fledged members of the academic club."¹⁶

¹⁶Eldred Smith. "Academic Status of Librarians," College and Research Libraries 31 (January 1970), 11.

SATISFACTION GUARANTEED OR YOUR MONEY BACK:

THE PROBLEM OF PERFORMANCE STANDARDS FOR ACADEMIC
AND RESEARCH LIBRARIES.

Paul B. Kantor

Customer Satisfaction

The phrase "Satisfaction Guaranteed or Your Money Back" stands as the ultimate performance standard in the world of commerce. When an operation is run for profit you can offer no stronger guarantee than the return of all of that profit if the customer is not satisfied. There are two obvious difficulties with trying to apply this kind of a standard to the operation of academic libraries. The first has to do with "your." It is rarely the case that the person who uses a library has paid any of his or her own money to that library. So we have nothing to return to him, and he has nothing to claim. The money has come to the library from a supporting institution, which only in the weakest sense represents those individual users. The second even more perplexing problem has to do with the word "satisfaction".

In the world of everyday experience the satisfaction of the consumer represents a reasonable measure of the performance of a product. This is simply because in most cases the consumer knows when something doesn't work, drawing on common experience with the same or related products. In the world of libraries it is difficult for the consumer (or customer, client, patron or user) to know whether the library is broken or not. There is a good chance that it is the only library he ever uses, and it may be running just about as well as it ever did. Although the following paragraph may have to be edited out of the conference proceedings I think it illustrates the problem very well.

The story is told of a "certain ethnic consumer" who went into the hardware store with the following problem. "The tree in my back yard just blew over in that storm we had and I need a saw to cut it up into fire wood. What have you got?" The clerk, eager (as are we all) to provide the finest in service, recommended a portable gasoline powered chain saw. He assured the customer that this was the latest in technology and would make the job so light that there would be time to watch the basketball games as well.

On Monday the customer returned to the store, obviously irritated and not in the least pleased with the service he had received. In his own words "this is the most terrible saw I have ever used in my life. I have never worked so hard as I worked this weekend and most of that tree is still sitting in my backyard. I want my money back."

The clerk was perplexed. He sat the saw on the floor and gave a tug at the starter cord. The gasoline motor roared to life. The customer leapt almost a yard in the air and shouted out "what's that noise?"

Much like the hapless customer of this little fable, the users of academic libraries are not at all sure what to expect, and may be very surprised if they ever hear the library in full operation.

For this, and other reasons, we are wary of using customer satisfaction as an ultimate measure of library performance. We seek instead to develop measures which can be used internally to the library and are based more on the professional standards of librarianship than on consumer satisfaction.

THE EXPECTATION OF COMPARABILITY

There is a very serious trap in this approach, which I call the expectation of comparability. It is rare for someone with managerial responsibility in a library to have worked in more than one or two other, similar libraries. It is perhaps even rarer for his boss to send him on extended site visits to learn how other, similar libraries manage their similar problems. The result is enormous variations in the finer details of procedure, organization and policy.

These variations are by no means trivial. My economic studies consistently reveal variations of as much as a factor of four in the cost of carrying out the same operation at different libraries. In the early years of performance studies it was claimed that the appearance of these variations was "proof" that the techniques of the studies were flawed. It has now become quite clear that the flaw is not in the technique of measurement but in the expectation of comparability. We presume that because people with similar training are doing similar jobs the cost and effort will be similar. A true story, based on the experience of some speakers who participated in a seminar on cost analysis will bring the point home.

At a 1986 seminar on cost analysis the speakers, all either experts in cost analysis, or library management, or both were asked to help with the tiresome but necessary task of stuffing copies of 12 talks into 150 plastic envelopes, for distribution to participants in the seminar. We were working in a room containing 150 movable chairs and three or four tables. In almost no time we had the work organized. We used the 18 (it turned out there were some administrative papers to be stuffed in the envelopes as well) chairs nearest to us at the front of the room. We placed one stack of papers on each chair, the stack of empty envelopes on a table in the corner, and proceeded, in a fashion familiar to all of us to walk across the room picking up packets one at a time. We went from the last of the chairs to the first of the tables grabbed an envelope, proceeded on to deposit it at the head table and then went across to the other side of the room to start the trip over again.

This was of course a room full of efficiency experts. It was not long before someone pointed out that we were wasting time walking back across the room. As a result (did this really save that time) we broke into two teams. One walked past the first nine chairs and handed a packet to a colleague who continued past the second nine chairs, took the envelope and stuffed it. There were 12 of us at work and so we now formed two six person teams.

Someone on the left hand side of the room noticed that he was still walking back without any papers and hollered out, "let's pull the chairs into a circle so we won't have to walk back empty handed". This suggestion was immediately followed. On one side of the room the chairs were pulled into a three-quarter circle facing in, and one worker sat down facing all those chairs and began to take items from the piles one at a time. On the other side of the room the chairs were pulled into a full circle facing in and the workers continued to walk around the outside of the circle, bending across the back of the chairs to pick up packets one at a time. The other five workers from the left hand side of the room stood and chatted for a while. It soon became clear that the one worker on the left side of the room was in no way able to match the productivity of the six on the right hand side of the room, who were soon waiting for packets to be prepared.

At this point a second person leapt into the fray. He commandeered half of the chairs in the circle and placed them in an arc facing him. He now took some five items from chairs and passed the packet on to his other sedentary co-worker who added the remaining four and placed them on a chair to be picked up by the workers on the other side of the room, who had been joined

at this point by the rest of the team. The work continued to completion in this mode. Two seated workers on one side of the room doing about half of the work and nine or ten walking workers on the other side of the room doing slightly more than half, if we count stuffing the envelopes. The productivity ratio is something like four or five to one, just about what we find as the extremes in our study of libraries.

One could spend hours analyzing this situation. Perhaps the workers on the right hand side of the room were enjoying a better working situation. They certainly received healthful exercise. For those without back problems the bending and lifting was probably a welcome relief from their usual line of activities. They certainly had more people to talk with, gaining whatever personal and professional benefits resulted from the opportunity to chat with one's colleague at work.

The workers on the left hand side of the room were burning off few calories, and, although they did have a chance to chat as they worked, they clearly were deprived of the opportunity to speak with a large community.

I don't need to belabor the point. These were all experts in library operations and the efficiency thereof. Yet they comfortably settled into two working routines one of which was four times as productive as the other.

SATISFACTION IN A LIBRARY

Let us return now to our main track and make some effort to define what could be meant by "satisfaction" if a library sought to guarantee satisfaction. We must first ask who cares about the performance of the library. Certainly the users of that library: the students, and the faculty care. The students care a lot but have a relatively soft voice. The faculty care in proportion to how productive and hungry they are. The administration of the university also cares. It cares at a "gut level" as it sees millions of dollars vanishing into this uncomprehended operation without ever hearing the motor go on. It also cares at the abstract level because it knows that without a good library it cannot be a good university.

We must also ask what is the product which is intended to satisfy these customers. The product of course is service. In fact it is two services which we may call accretion and access. This choice makes it difficult to resort to a shorthand notation since up to the third letter these two concepts will be catalogued together.

Access

Then we turn to the service of access the situation becomes rather more complex. I have spent a good deal of time thinking and writing about it in the past ten years, and I must refer you to some of those written works for details of what I am about to present.

To begin with if a library has somewhere between one and ten million books it represents a resource requiring organization. If the user of a library could examine six books per minute just to estimate whether they are the book that he is looking for, he could, working a 40 hour week, examine about 750,000 books per year. Thus it would take somewhere between a year and a half and 15 years to go through the library and find a single book.

Historically libraries have developed a hierarchy of means to reduce this time to something reasonable. The first step is classification which results in an approximate ordering of the book by subject matter (or, in the case of fiction, by author) so that a reader who knows what his subject is or who knows the name of the author can point himself to approximately the right place on the shelves to continue the search. Even in a large academic library this means that a user interested, for example, in mathematical theory of games, need scan no more than 3 or 400 books in order to find the one or ones that he is looking for. This task is quite manageable and, in fact, many respected scholars use the library in roughly this way.

The library has of course taken the process much further. Cataloguing represents each book, whether it is presently on the shelf or not, by a card. In fact it is represented by a number of cards so that one of them may be placed in an author file and others in a subject file. As you all know there is still problems with this kind of organization. Very few users know the correct corporate author of a conference proceedings. Very few catalogers are 95% accurate in their identification of the subjects of a book. In fact, some horror stories can be told about Library of Congress cataloguing and publication for books dealing with economics.

With the computer it is becoming possible to search a vast file of "cards" by other identifiers that may be better known to the user such as the time of publication, the place of a meeting, the home institution of the author, or an analytic analysis of the contributors to and chapters of a multi-author work.

Accretion

Accretion is the function corresponding to the fact that the university puts money into a black box called the library and as a result it owns more books each year than it did before. Inside that black box there is some kind of collection management function, an acquisition function, a preservation function and a cataloguing function which we will not discuss at this point.

This black box is to some extent driven by requests which arrive from time to time from the faculty or other concerned consumers.

There are three broad aspects that contribute to the satisfactory functioning of this machine.

1. One may ask: "Is this increasing stack of books the best for the money?" That goal is pursued if never achieved, through two kinds of input. The first is what we may call "expert" input. By this I mean experts at the management of books rather than experts at scholarship per se. These experts review bibliographic literature and match what they learn to the programs of the university to put the best books on the shelves. The second kind of input is what might be called "user" input. The users know an enormous amount about the subject matter of the books, but they know extremely little about bibliographic resources, review journals and the processes of library acquisition. We may say that as a long range goal libraries should nonetheless seek to enhance and make better use of user input.

2. "How fast does a dollar, or a request, get turned into a book?" There is nothing very abstract about this notion. Some period of time elapses between the initiation of a request, or the time at which it would be possible for the library to initiate that request, and the actual arrival of the book on the shelf. The shorter this time is the more satisfied everyone ought to be.

3. "What is the process overhead?" The total costs for putting a book on the shelf is composed of the purchasing shipping costs for that book plus all of the costs involved in processing which includes not only acquisition and ordering processes but also the vital processes of cataloguing. As a very rough surrogate one could say that the process overhead is approximately equal to the technical services salary divided by the acquisition budget. In many libraries this ratio is close to 100%. The goal is obviously to decrease it, without significant loss in quality.

With all of these aids in place it is still impressive if those who seek books in a major university library are satisfied as much as 65% of the time. Let us try to look at this in a more concrete way. We intend to descend a ladder of specificity from goals to measures to standards.

MEASURES OF ACCESS SERVICE

The goal in every case is to facilitate access. Broadly speaking this means to improve the chance that people get what they need, and to reduce the burdens that they face in getting it.

Measuring Availability

In practice this evolves into two families of performance measures. The first family have to do with availability, or chance of success. The most effective analysis reduces availability to the product of four or five nearly independent factors. These factors have to do with the scope of the collection, the user's ability to find the starter card on the card catalogue, the interference provided by other users of the library, the library's skill in keeping track of its inventory, and the user's ability to find a book when it's sitting on the shelf right under his nose.

The mechanics of this kind of analysis are spelled out in detail in papers by myself, in collaboration with Professors Shaw and Saracevic, by Whitlatch, and many others. A detailed theoretical and practical exposition of the techniques is given in the Association of Research Libraries book "Objective Performance Measures for Academic and Research Libraries". (Buy One Now!)

In a striking trial study of this technique by five ARL institutions it was found that an overall success ratio of 60% is impressive indeed. This is due to the fact that each of the five factors involved has trouble reaching the level of 90%, and if you take 90% of 90% of etc. until there are five factors, you wind up with only 59% plus change.

It is hard to push any one of the factors above 90% performance and so it is very hard to push the library as a whole above something like 60 or 65% performance. By performance here we mean the ratio of searches that result in the desired book in hand, to all searches for specific known items. The analysis is more difficult for the case of subject searches, and the few studies that have been done indicate (as we would expect) that the chance of satisfying a subject search is a little bit higher.

The late Hugh Atkinson, approached the problem of 60% satisfaction in an important and novel way. He proposed that if one-third of the books people want are not going to be found by them in the library the library should undertake to provide at least one-third of those needs by interlibrary borrowing from other institutions. In other words, books borrowed from other institutions should represent more than 10% of all the books placed in the users hands by the library.

I do not have any published statistics showing whether that particular target was met, but an analysis of the ARL statistics for 1984-85 show that for university libraries as a whole the significance of interlibrary borrowing is low - about one item borrowed for each thousand dollars of total expenditure. At the University of Illinois, the corresponding figure is 9.4 items borrowed per thousand dollars of expenditure. Roughly speaking, under Atkinson's guidance, interlibrary access to library materials has become nine times more effective at the University of Illinois than it is at the average ARL library.

Measuring "accessibility"

In discussing the other aspect of access we use the term accessibility. This refers to both the difficulty and delay experienced in getting hold of books or other materials. The effort can be measured most effectively by what are called simulation experiments. Surrogate users are sent into the library to find things and we measure how hard it is for them to do so. How burdensome is the paperwork, how confusing are the signs and so forth?

The effort is usually measured in minutes required to complete a particular kind of access activity. Delays, on the other hand, are typically measured in days, weeks or even months. These are most effectively measured not by "tagging items" but by a powerful technique called flow analysis.

When we tag items we must wait for them to come through the pipeline before we know how long it has taken. Since some of them never get through it becomes difficult to decide when to sit down and analyze the results. If materials are time stamped when they go into the pipeline you can avoid this problem by just catching things as they come out of the pipeline and finding out how long the first 300 items to come out have been in the pipeline. Their average is probably a good indication of the average delay time.

There is an even quicker way which forms the basis of flow analysis. Essentially it relies on the fact that we usually know how many items are pending or in process, and it is very easy to find out how many are being completed each day. In fact those completions represent the kind of performance statistics that are usually available in libraries.

The key to flow analysis is that the average delay in processing an item is simply equal to the total number of items in process divided by the average rate at which they finish. For example if there are 14,000 books on order, and they come in at the rate of 140 per day, then the average wait is 14,000 divided by 140, or 100 days. For further details we refer you again to the ARL book.

PERFORMANCE MEASURES. PERFORMANCE STANDARDS

I have managed to talk a lot about performance measures without saying anything at all about standards. I want to close this talk by saying a few things about performance measures that include the troublesome problem of cost. However, I still will not say anything about standards and it is probably time now to say why. A standard represents a target level for a performance measure. Standards cannot be created by fiat. To be effective they must involve qualities that are under the control of the library, that are meaningful to those who manage the library, that are meaningful to those who use the library, and are meaningful to those who pay for the library.

Furthermore, and even more importantly, standards must be realistic. In order for a standard to be realistic we must have some idea of what is achievable. To know what is achievable we must know the results of performance measurement at more than a handful of academic libraries. Thus, the intelligent definition of performance standards for libraries must wait its turn while we get on with the business of widespread application of uniform and efficient performance measures at academic libraries..

COSTS AND PERFORMANCE MEASURES

Now for a few words about the unpleasant problem of costs. Since libraries provide services, the relevant economic concept is what is called "functional cost." Functional cost is the analog, for service industries, of the unit cost in production industries. If you manufacture chairs and tables you can analyze the costs of your factory and express them as "\$170 per table, plus \$32 per chair". This analysis involves the allocation of certain amounts of overhead, such as the building and equipment, and the administrative staff, to the chairs and tables produced. On the other hand some of the costs are directly assignable, such

as lumber that is used in chairs or the salary of the worker who glues the rungs of the chair together. If you make more chairs you will necessarily have to pay more in those categories and if you make fewer chairs you should in principle be able to pay less. On the other hand if you make more or fewer chairs you may not be able to change your equipment and building costs.

The library, although it contains tables and chairs, does not sell them to its customers. What it does is sell, to the university as a whole, a variety of services. Economically, the three most important services are the circulation of books, the provision of reference service, and the access to in-house use of books.

Thus, to complete a functional cost analysis, one must assign all of the costs of library operations to those three services. This can be done and, in fact, it can be automated, using the functional cost analysis (FUNCOST) software which has been developed by Tantalus, Inc. (Buy One Now!)

The FUNCOST software comes with a 50 or 60 page manual which contains a very thorough discussion of how to use it and of the problems in doing functional cost analysis at libraries. In a nut-shell, the difficulty is that about 90% of the expense is overhead on these three principal functions, and not more than 10% is directly attributable. Thus, as with all cost analysis, the key to having a useful management tool is to be careful and consistent in the rules for allocating those costs. The costs to which I refer are of course, the acquisition costs and the technical services costs.

I should mention that Robert Hayes has tried to sidestep this question by declaring that both the acquisition budget and the technical services budget really represent capital costs of library operations. I think this does not solve the problem because, to the university, they are definitely current operating expenditures. In addition, it would take more than the wisdom of Solomon to arrive at a meaningful depreciation lifetime for a book in an academic library. The lifetime of a book that no one reads is zero, while the lifetime of a few classics is unknowably long.

Relating Costs to Levels of Availability

There are even problems within problems and I will close by mentioning one of those. The whole idea of functional cost is based on the notion that the costs is somehow related to the number of units of service delivered. In other words, if it costs \$30,000 to do a thousand units of something we expect that the next 100 will cost \$3,000 and there is some kind of unit

functional cost of \$30. For example we might talk that way about the purchase price of books. Similarly we might roughly persuade ourselves that if it costs \$50,000 to do 1,000 on-line searches we might expect the next 100 to cost \$5,000 with a unit cost of \$50.

The deep idea is this. Service is not simply delivered, like a chair or a table, it is delivered with some probability of success. This is precisely the availability measure that we described before. Now we ask, if it costs us \$6 million to achieve a level of 60% satisfaction for users seeking the specific books that they want, do we expect that we would get a hundred percent satisfaction at \$10 million? Of course not. At least not by a line of reasoning that would suggest that if we spent \$12 million we could achieve 120% satisfaction.

There is no sure-fire formula that will take account of the diminishing returns that we face as we try to improve performance. I will leave you with a very useful rule of thumb. This rule is:

$$\text{Cost} = C(50\% \text{ performance}) \times (\text{HITS/MISSES}) \times \text{Quantity}$$

At a 50% performance level the number of hits or successes is exactly equal to the number of misses and so the total cost is the 50% performance cost times the quantity of service delivered. But as service rises to a 60% level the ratio of hits to misses becomes 60 to 40, or 1.5. This amounts to saying that the unit cost of each unit of service delivered at this level of performance will be 50% higher than at the 50% level. If we push up to 80% the ratio of hits to misses becomes 80 to 20, or 4. As I say there is no profound theoretical justification for this formula, but it provides a very useful reminder of the enormous cost associated with trying to press towards 100% performance.

Uplifting ending

This underscores the profound wisdom of the alternative approaches involving sharing of resources and knowledge among the academic libraries of the country and the world.

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LONG-RANGE STRATEGIC PLANNING FOR INFORMATION RESOURCES IN THE RESEARCH UNIVERSITY

by Robert M. Hayes

PURPOSE

This is a brief description of the Research Program being carried out through the Graduate School of Library and Information Science (GSLIS), UCLA, under funding from the Council on Library Resources (CLR). The program is focussed on the issues, problems, and needs for research with respect to long-range strategic planning for libraries and information resources in the research university of the future. It has the following purposes:

- o To explore the effect of technology on the ways information resources will be used in the research university
- o To seek better understanding of the information resource requirements of major disciplines
- o To determine the role of information resources in the work of individual scholars, researchers, students, and teachers.

The objectives in these investigations are two-fold. First, there is need to understand better the relationship between information resources and the work of scholars and teachers, especially in the context of technological change and in recognition of differences among disciplines. Second, there is need to determine how the university should plan and organize so as best to meet those requirements.

These two objectives are inextricably inter-related, so the project deal with both aspects, since it would be inappropriate to separate the problems in determining needs from those involved in meeting the needs.

CONTEXTS OF INTEREST

In undertaking this project, UCLA is responding to several related concerns. First, there is the general concern which transcends universities; it relates to the largest context of "information as a resource in our society". Second, there is the more specific concern with the situation in the university as an institution. Third, there is the specific concern that UCLA has about the future of its own "library", which at UCLA has been interpreted with the broadest possible definition. Fourth, there is the academic program concern with continuing to strengthen the content of professional education in library and information science, both in general and specifically in the GSLIS at UCLA.

The Most General Context

The effects of information technology and of the increasing proportion of the national work force engaged in information work have been the focus of concern with "information policy issues", including such things as interaction between the public and private sectors, the best means for increasing the availability of information to the public, the effects of government policy upon that availability. Within that general context, a matter of fundamental importance is the relationship between national productivity and the use of information as a resource in society.

Part of the general context arises because of the complex interaction between modern communications and computer technology in the delivery of information resources. In this respect, the California legislature asked the University to examine "Telecommunications and Information Policy". Of course, there is a strong focus in their concern upon issues related to technologies rather than on the information. There is even more of a tendency to emphasize the industrial and commercial aspects and to ignore the role and needs of the academic community. Furthermore, there is a natural concentration of concern on the technologies, as such, without clear attention on the institutions of society by which those technologies become effective, among them being the libraries and especially academic libraries.

In recognition of these concerns, both general and specific, conferences were held at UCLA -- one in 1980 sponsored by the Council on Library Resources, the other in 1984 sponsored by the California State Library. The first was concerned with the future of the university with respect to the changes; the second with "Libraries and the Information Economy of California". Both clearly identified the need for research to develop the framework on which to base "information policy" decisions.

These prior commitments by UCLA to the area of general information policy studies lie at the core of the current proposal. Part of the purpose of the Research Program is to continue these kinds of studies, with special focus on information in societal productivity and the effect of information policy decisions upon the library and its role in society.

Even more generally, beyond the importance of the "information economy" of the United States, it is necessary to recognize that these issues have the same importance elsewhere in the world. International data flow and the use of information resources in both developed and developing countries is therefore also a matter of concern for the Research Program.

The University Context

The academic research university is an institution which depends upon the ready availability of information resources, of all kinds. In a very real sense, it is the "information institution" beyond all others. Those information resources take a variety of forms: the faculty, the library, the computing equipment, the media and related facilities, the laboratories, the museums, the archives. And they are used in the university for a variety of purposes and in a variety of ways.

Until recently, these information resources have been relatively stable, well defined, and reasonably well organized within the university. Scholars

have well established patterns and expectations about the use and availability of them. The university has created libraries, computing centers, and similar administrative units to manage them. While there have been problems and issues of concern within individual institutions, until recently they represented simply the usual ones of management in a complex enterprise.

The changes in that previously stable, well defined situation are dramatic and they have immense effect upon both the organization of the university and the patterns for use of information resources in scholarship, research, and instruction. Fundamental changes are affecting the ways in which information is created, produced, organized, made available, protected and preserved, and used. They are affecting the ways in which scholars work, the methods of publication, the means for distribution and access. They are affecting the organization of the university and of the libraries and computing facilities within them. Simply to illustrate, there are immediate concerns on the UCLA campus with the acquisition of instructional computer programs, data bases, and documentation. Currently, faculty are forced to deal with these in an ad hoc, individual manner; as these forms of information resources become increasingly more important to both instruction and research, more formalized means for management of them will be needed. As another example, management of the UCLA Film Archives has been a matter of concern for several years, as these information resources have become important in both scholarship and instruction; the ad hoc committee appointed to advise on this concern led to the appointment of the continuing committee on The Library of the Future.

Just as the international implications are important in the most general context, they are significant for the university context as well. The British, through SCONUL, are concerned with exactly the same kinds of developments in the use of information resources within universities, and there are efforts in the European Economic Community more generally to deal with them. Even in the developing countries, universities face the same kinds of questions. Thus, the impact on universities internationally should also be considered within the scope of the Research Program.

The UCLA Context

Even more specifically, UCLA itself has been concerned with these kinds of questions in the context of its own strategic planning for library and information resources on the campus. Similar questions were posed by a special ad hoc committee, convened by the Executive Vice-Chancellor, which was charged with responsibility for recommending the means for handling the wide range of information resources available to the campus community. The effects of formats, the means for access, the needs of users, the range of alternative organizations, the management of collections (of a variety of media), the overwhelming implications of the technologies -- these all raise problems essentially unsolvable by a committee, especially one of limited life, but which must be solved if planning is to be effective. However, the result of that ad hoc committee was the formation of a long-term Committee on the Library of the Future with responsibility for development of the long-range strategic plans for the University with respect to these issues.

The Professional Educational Context

Finally, there is the context of education for library and information science. The Research Program is seen by the campus and GSLIS as a means for maintaining the position of GSLIS as one of the leading institutions in the country in that field. The insights gained from the studies it is hoped will influence the future educational programs of GSLIS and of the University as a whole. And the relationships created between the School and the other academic programs of the University establish a broad base of support for the programs of the School.

INTENDED RESULTS

The output of the ongoing Research Program will be both specific to UCLA and of more general value. First, an intended result will be a strategic plan for consideration by faculty and administration at UCLA as part of the basis for their development and management of information resources at UCLA itself; with that as an intended result, there should be great incentive for involvement of UCLA faculty and administration in the process. Second, and directly related to the first, there would be an explicit testing of a process for academic strategic planning with respect to information resources; the intent is to document that process and the results in a manner that will make it available to other institutions to build upon and relate to their own specific contexts; therefore, every effort will be made to provide a record that will be objective with respect to problems as well as process, results, and successes. Third, there should be some immediate publications arising from the studies in support of the work of the Advisory Committee and the Disciplinary Task Forces; while these will not reflect the results of formal research projects, the data developed should be of interest to others concerned with the same issues and will therefore be made available as publications of the program. Fourth, it is intended that there will be formal research projects identified by the Advisory Committee and the Disciplinary Task Forces of sufficient magnitude and importance to represent major contributions to advancement of the state of knowledge in this field; those projects will themselves be a most important result of the Research Program, and reports, articles, and perhaps books arising from them will provide the most tangible and significant output. Finally, as part of the means for communication, it is planned that there would be periodic conferences involving universities concerned with parallel Research Programs; aside from the immediate value they will have for communication, it is expected that they will also result in publications, as "conference proceedings" or even as monographs.

ADMINISTRATIVE ASPECTS OF THE PROGRAM

Time Schedule and Budget

It is expected that the Research Project will involve between three and four years, starting on 1 January 1986 and lasting until 31 December 1989. The first year, calendar 1986, was planned to be focused on creating the management organization, the Advisory Committee, the Disciplinary Task Forces, and the supporting study activities. Of those, the first two were virtually already in being, so the principal activities of the past year related primarily to the efforts in establishing Task Forces and supporting studies.

Calendar years 1987, 1988, and most of 1989 will be devoted in part to a continuation of the work of the Disciplinary Task Forces, supported by specific studies, in the same pattern as was the case in 1986. Beyond that, though, the major focus will be on carrying forward work on research projects generated out of the ongoing activities.

The Research Program has been funded at a level of \$400,000 (total for the three to four year period). About 20% has been budgeted for management, with the remaining 80% committed to substantive work -- supporting studies, research projects, and communications.

Administrative Structure

The project, as planned by GSLIS, is based on six major components:

- 1) a management component, which will be responsible of those aspects of the Research Program, including the necessary logistical arrangements for the other activities;
- 2) an Advisory Committee to the management of the Research Program, starting with members of the UCLA "Committee on the Library of the Future" but augmented with additional faculty and outside representatives, which is responsible for advice with respect to the overall conduct of the program, for review of proposals for research projects for funding from the program, and for specific concern with those issues relating to the organization and management of information systems and services in the University including the identification of research that may need to be undertaken to resolve those issues;
- 3) a set of "Disciplinary Task Forces", involving faculty from specific academic areas, which will be responsible for identifying the needs for information resources in their areas of interest or, as part of that work, identifying research that may need to be undertaken in order to establish those needs and the related ways in which information resources will be used;
- 4) a set of study activities, parallel to the Advisory Committee and the faculty task forces, to provide immediate support to their work by obtaining and analyzing currently available data concerning specific issues identified by the Advisory Committee and Disciplinary Task Forces;
- 5) a set of research projects, to be initiated as a result of the identification of needs for research by the Advisory Committee, the Disciplinary Task Forces, and/or the supporting study activities;

- 6) an active program of communication for the purpose of making the process involved in the work of the Research Program and the results obtained in it widely available, including a newsletter, seminars, conferences, formal publication of both articles and monographs, and talks such as this one.

In this structure, the Advisory Committee and the Disciplinary Task Forces serve as valuable means for involving faculty from the broad range of University interests.

The Substantive Components

The supporting studies and research projects provide the substantive aspects of the program, and I will discuss them in some detail a moment.

The Communication Component

A central objective of the project is to provide documentation of both the process and the results in ways that will assist the university community at large in determining how to proceed with this kind of strategic planning. To that end, a variety of means for communication has been implemented:

- 1) General Publicity
- 2) Meetings with groups within the UCLA community
- 3) Colloquia, seminars, and sponsored talks
- 4) Conferences
- 5) A Newsletter
- 6) Publications

A publicity release was distributed to appropriate media, professional and general. A different form of general publicity is provided by opportunities for formal talks given in various professional contexts, which have included presentations at OCLC, at the IFLA Conference in Tokyo, and at universities throughout the United States and elsewhere.

Every effort has been made to communicate the nature and purpose of the project throughout the UCLA campus community, both academic and professional. Presentations have been made to the UCLA Academic Senate Committee, the UCLA Committee on the Library of the Future, the UCLA Office of Academic Computing, the Librarians' Association of the University of California, media centers, and individual groups of faculty from many academic departments.

It is planned that there will be a series of conferences held under the auspices of the project. The first was held in early September 1986. It was a small, invitational conference for the purpose of discussion among a few interested universities with focus on the possible approaches to long range, strategic planning for information resources in the research university. The UCLA project was used as an example, but the primary purpose was to gain the benefit of general discussion.

The first issue of the Newsletter has been published; it was distributed in January 1987. Draft text for issue 2 has been prepared. The following is the current plan for content of upcoming issues:

- | | |
|----------|---|
| Issue 2: | Substantive review
CD-ROM
Copyright
Electronic manuscripts |
| Issue 3: | Substantive review
References
Instructional authoring systems
OCR applications |
| Issue 4: | Substantive review
Union catalog
Electronic mail
Preservation |
| Issue 5: | Substantive review
Expert systems
Conversion projects
National policies |

SUBSTANTIVE ASPECTS & PROGRESS

I turn now to the substantive aspects, structured around the following conceptual framework:

- o Academic program needs
- o Information resources, facilities, and functions
- o University administrative issues
- o Political and social policies affecting the university
- o Information research issues

Academic Program Needs

By the start of 1987, a number of faculty from disciplines throughout the campus had become involved in the program, as will be detailed in a moment, with the result that several supporting studies have been initiated and some research project proposals are in development. Among them are some from the Graduate School of Library and Information Science (GSLIS) itself, but it should be made clear that the objective is to generate research interest from all disciplines, not simply from the library school. Those projects will serve either as the focal point for work in subsequent years of the Research Program or as the basis for proposals to funding agencies (including the CLR but also including others). Indeed, already in a few cases such proposals have been submitted to funding agencies. Thus, in addition to the research projects funded from the Research Program itself, it is intended that a number of research proposals will lead to funding from other agencies.

In this respect, it is important to note that the funding provided from CLR is minimal in the context of the cost of research projects needed to deal with the problems of concern. It does provide the basis for planning, for definition of research needs, for exploratory investigations and studies,

and for initiation of studies, but many research projects themselves will need major funding, with support possibly in part from CLR and in larger part from other agencies.

In cases in which an ad hoc study may be able to serve the needs of the Advisory Committee or a Disciplinary Task Force, the Research Project will establish a supporting study, with graduate students as Research Assistants under the direction of faculty of the University carrying forward the study. Some studies may involve faculty and students from GSLIS, some from other schools or departments, and many from both. Some studies may involve staff of the University Library System; some staff from the Office of Academic Computing; some staff from other facilities responsible for archives of various kinds.

A supporting study may involve assembly of a bibliography or of relevant data. It may involve a statistical analysis of available data. It may involve a brief survey (such as a polling of faculty with respect to a question). It may involve writing to external sources to obtain data that is available from them. It may involve a brief experiment to determine the effectiveness of some tool. It may involve preparation of a position paper, with identification and evaluation of alternatives. It may involve an analysis of transaction data from online catalog operations.

The point is that a supporting study is brief in time, limited in scope, based on readily available data (frequently on data that are published). It should be within the capability of graduate Research Assistants, working under suitable faculty direction.

Two categories of Supporting Study have been identified: generic studies and specific studies. The first category will include studies that appear to have wide applicability across the campus; the second will be those that are specific to particular disciplines.

The development of research projects under the direction of faculty and/or librarians or other information professionals at UCLA is one of the primary objectives of the project. This reflects the hope that there will be identification of problems of substantial interest to faculty from a variety of disciplines, including but not limited to library school faculty.

The scope of research falling within the objectives of the project will be determined by the Advisory Committee, as part of its responsibility for review and recommendation for funding of proposed research projects. However, the general context has been clearly identified in the description given above for the charges to the Disciplinary Task Forces.

From the standpoint of the academic program aspects of strategic planning, though, the effort is intended to answer the following kinds of questions:

- 1) What are the current and expected future needs for information resources ?
- 2) What are the current and expected future changes in publication and distribution of information?

- 3) What are the different media of importance, both currently and as expected in the future?
- 4) What role do the different media play in research, scholarship, and education?
- 5) How do faculty and students use information resources and how will they do so in the future? ..
- 6) What are the means used for access to and use of information resources?

These questions are intended to be representative, not complete or prescriptive. Some of them may be answerable from the knowledge of the members of the Disciplinary Task Forces or their colleagues; some of them may require supporting studies which can be included in the ad hoc work of the Research Program; some, though, will require the formulation of a research proposal for consideration as a formal project, funded either by the Research Program or by an external agency.

It is hoped that each Task Force will deal with those questions as well as the following more specific foci of concern:

- o Media for collection and acquisition policies for them
- o Means for cataloging, classification, and organization
- o Role of expert systems in acquisition and organization
- o Preservation o Storage o Access
- o Equipment and facilities o Staff development

The Task Forces should try to consider the "20-year context" for the following issues:

- o The future needs for library and other information support in the specific academic program area
- o The future of publication & communication in that area
- o The future role of the library and its collection
- o The future of computers, communication, and other technology
- o The future for information personnel
- o The future for facilities and equipment
- o The future for economic resources

And within that 20-year context, the Task Forces should consider the following specific concerns for the coming 5-year period:

- o Collection development, management, and organization
- o Facilities and automation development
- o Financial requirements

During the past two-month period, discussions were held with faculty, librarians, and academic administrators from a number of academic program, departments, schools, and organized research units. In most cases, these have led to the request for funding of a Supporting Study to deal with identification of the needs for information resources, of every kind, in support of the academic program. The following describes each of these discussions and the related Supporting Study. In each case, I will identify

the academic program; then, I will briefly describe the focus of discussion; finally, I will conclude with a review of current status and future plans.

Program: School of Medicine.

Description: The focus of discussion is on "the influence of new information resources on clinical teaching". It includes coverage of simulations, instant access to information through Medline, decision support, use of computers in curricula. Issues include variations in needs and use across disciplines or across groups of faculty and students.

Status: A proposal has been received for a Supporting Study, for three months at a budget of \$1500. Approval has been given for it. Future plans are still to be formulated, based on the results.

Program: Center for African Studies.

Description: The focus of discussion is on the needs for information resources in support of "developing countries research". This includes the needs both for academic research in the U.S. and for developing countries themselves. Issues include needs for professional staff qualified to develop such resources, statistical data about availability of information resources in the U.S. in particular geographical areas and subject, the forms and kinds of information resources needed, and the use of such data in support of research and teaching.

Status: A Supporting Study has been initiated to examine the problems in dealing with the identified issues. The result was the development of a proposal, submitted to the Department of Defense Academic Research Support Program, for a six month project to examine that feasibility of dealing with the identified problems. A proposal has been received for a supporting study on the information resource needs for bibliographic support to study of African Women.

Program: Program in Applied Linguistics.

Discussion: The focus of discussion is on the needs for information resources in support of research and instruction in "rarely taught languages". Issues include the form and availability of such materials and the means for gaining access to them.

Status: A supporting study has been initiated, cooperatively between the Program in Applied Linguistics and the GSLIS, with a graduate student from each program working together to identify the best means for gaining access to such materials.

Program: Center for Latin American Studies.

Discussion: Several foci of discussion have been identified: the use of computer networks for communication with Latin American countries, the need for training materials for preparing information workers in the use of microcomputers and computer networks in Latin American countries, the maintenance of statistical data files on those countries.

Status: A proposal has been submitted to Unesco (to be funded by contract through the International Federation of Library Associations, for the development of a training package for computer use by information workers in Latin American countries. It will be handled through the GSLIS, but with cooperation from the Center for Latin American Studies.

Program: Center for Medieval and Renaissance Studies.

Discussion: The discussion has focused on the needs for information resources to support studies in the Center.

Status: A supporting study has been initiated, involving a graduate student in the Center, to examine those needs.

Program: Department of History

Discussion: The discussion has focused on several data projects relating to the handling of source material in Catalan, using microcomputers, and the computer indexing of a collection of source materials.

Status: A proposal for initiation of one or more supporting studies has been received, though not yet acted on.

Program: Department of Music

Discussion: Discussion has focussed on the cataloging of composite recordings in the Music Library, especially with respect to authority files.

Status: A supporting study has been initiated as a joint effort of the Department of Music and the Fine Art Librarian.

Program: Theater, Film, Television

Discussion: Discussion has focused on the application of optical disk methods in instruction.

Status: Preliminary discussion.

Program: Center for International and Strategic Affairs

Discussion: Discussion has focused on the need to relate the collection of materials used in direct support of the Center's research and teaching functions to the wider range of resources and users of the campus.

Status: Preliminary discussion

Program: Department of Neurology

Discussion: Discussion has focused on the management of "imaging data" from neurological research and practice.

Status: Preliminary discussion

Program: College of Fine Arts

Discussion: Discussion has focused on the development of means for access to the literature related to television: aesthetics, technology, psychological impact, economics, etc. International coverage in response to the needs in teaching and research.

Status: A proposal has been received for a supporting study and approval has been given committing \$1500 to it.

Program: Department of Neurology

Discussion: Discussion has focused on the development of a microcomputer based system for management of a patient record file of data on surgery for epilepsy.

Status: Proposal for a supporting study has been submitted.

Program: School of Engineering, Department of Chemical Engineering

Discussion: As a result of discussions with the Dean of the School of Engineering and the Chairman of the Department of Chemical Engineering, needs were identified for information resources in support of Hazardous Substance research. Of special significance is the need for geographic indexing and retrieval of textual, numeric, and perhaps image data.

Status: A proposal was submitted to the National Science Foundation for a major research program on Hazardous Substances; it has been funded and will be initiated this academic year (possibly in May 1987). Included among the tasks is the establishment of a Hazardous Substances Information Center.

Program: Department of Chemical Engineering

Discussion: Discussion has focused on the need for research on various aspect of the preservation of "brittle books", but especially on the effects of encapsulation of an entire volume upon the chemistry of brittization.

Status: A prospectus for a research program has been submitted to the Council on Library Resources.

Program: School of Architecture and Urban Planning

Discussion: Discussion has focused on the information resources needed to support teaching and research in the fields of architecture and urban planning.

Status: A research project was initiated last year.

Program: Department of Psychology

Discussion: The focus of discussion has been on the effect of technology, such as student workstations, upon the process of education.

Status: A supporting study was funded last year. A proposal for a larger scale research project is expected.

Program: School of Engineering

Discussion: The focus of discussion has been on the effect of electronic mail upon scholarship, in both teaching and research.

Status: A proposal for a research project is expected.

Program: Graduate School of Library and Information Science

Discussion: The focus of discussion was on the progress of CD-ROM publication and, eventually, its effect upon scholarship.

Status: A supporting study was initiated last year that resulted in a report on the current extent to which material is being published in CD-ROM formats. A summary of that report will be presented in the next issues of the Newsletter on this project.

Program: Graduate School of Library and Information Science

Discussion: Discussion has focused on the needs for information about limits placed on academic access to information resources.

Status: A supporting study has been initiated aimed at the establishment of a First Amendment Information Resources center.

Program: Graduate School of Library and Information Science

Discussion: Discussion has focused on the needs for information about the effects of copyright on academic research and teaching.

Status: A supporting study has been underway to determine the policies of major universities with respect to copyright. A survey was sent to all Association of Research Libraries (ARL) institutions, to both the library and the university's legal counsel. Replies have been received from all but two of those institutions and, in most cases, from both the library and the counsel. Those results are now being analyzed.

Program: Department of Pediatrics

Discussion: Discussion was focused on imaging as a tool in pediatric research, teaching, and practice.

Status: Preliminary discussion

Program: Institute of Archeology

Discussion: Discussion was focused on the data base development in the Institute of Archeology.

Status: Preliminary discussion

Program: School of Nursing

Discussion: Discussion was focused on patient records as tools of research and teaching in the field of nursing. Special attention was paid to the possibility for joint efforts with the BioMedical Library towards the objective of a proposal to NLM in the context of the IAIMS program.

Status: Preliminary discussion, with next meeting on 13 March 1987.

Information Resources, Facilities, and Functions

During the past two months discussions were held with staff of various libraries on campus -- the central library and the branches. These were focused on specific kinds of opportunities for research of campus information resources and means by which the University Library System can better serve them. Again, these will be presented in the same framework as the ones for academic programs.

Library: Popular Music Archives

Discussion: Two topics were the focus of discussion: 1) the conversion of the catalog of the Popular Music Archives collection, 2) preservation of popular music materials.

Status: Preliminary tests have been initiated to determine the feasibility of using Optical Character Reading equipment for catalog conversion. This is based on an existing project, under sponsorship of the National Agricultural Library, for evaluation of OCR equipment for bibliographic purposes.

Library: Belt Library of Vinciana

Discussion: The focus of discussion has been on the conversion of the catalog and index files of the Belt Library of Vinciana.

Status: Preliminary tests have been initiated to determine the feasibility of using Optical Character Reading equipment for catalog and index conversion. This is based on an existing project, under sponsorship of the National Agricultural Library, for evaluation of OCR equipment for bibliographic purposes.

University Administrative Issues

UCLA, as an entire campus, has initiated a strategic planning effort. A committee has been established to oversee that effort and advise Chancellor Young concerning academic program priorities. As the first step in the process of planning, a conference was held at the UCLA Lake Arrowhead Conference Center. It was structured around a dozen major topics, among which was one focused on the information technologies. It is to be hoped that, as the planning effort continues, the results of the research program presented in this report, with its focus on Strategic Planning for Information Resources, will be of direct value.

At this stage, there have been no other substantive discussions, with either faculty of administrators, of the administrative issues that need to be considered in the planning process. However, the following are obvious issues:

Financial Planning
Personnel Policies
Space Planning
Organizational Alternatives

As has been previously reported, dealing with these issues in an informed way requires data about the campus activities related to information resources, their use and the facilities through which they are made available. To test the feasibility of developing those data, sample files have been created of relevant data in four categories:

Persons
Academic Programs
Information Facilities
Projects

Political and Social Policies Affecting the University

In the course of the effort last year (1986) to establish the framework for this project, several issues were identified that related primarily to factors outside the University itself and yet which have dramatic effect upon the ability of faculty and information professional to use information resources effectively in carrying out the University's responsibilities. These external factors need to be identified and means created by which the University's needs and obligations can be recognized in the political processes that lead to policy decisions at a national and state level.

Recognition has been given in the UCLA administration of the need for UCLA to establish means for such strategic planning, with the establishment of an administrative committee.

The following are a few illustrative examples of issues that might be considered by that committee:

Copyright (see above among the projects)

Access to Government Information (see above among the projects)

Restraints on Publication and Distribution of Information

Information Research Issues

Several areas of research on the issues in strategic planning for information resources have been discussed, some of them as outlined above:

Preservation of Brittle Books

Expert Systems in Reference

CD-ROM Publication

CONCLUSION

The program I have described is broadly conceived and broadly based. It has been undertaken as a University commitment in which the library school serves as the administrative focal point. It has been designed to elicit the widest possible participation of faculty, information professionals, and academic administrators throughout the campus. In large part, it is a process with political objectives -- in the best possible sense of that term -- as well as technical and research objectives.

There is one final personal commentary I would like to make. In starting this process, I was well aware of both the potentials and the problems that would be involved. Both have been well exhibited. The potentials are clear in the extent to which information resources, of the wide range with which we are concerned, are clearly necessary, being created, and being used; the primary task, indeed, is to raise the consciousness of the academic community at large to the magnitude of resources needed and available. The problems really are not problems but just the reflection of the facts of academic life. Faculty are, by nature and discipline, tunnel-visioned. They may or may not be aware of the broad range of information issues, but in either case they are rarely concerned about them unless they can be made central to the focus of their own research interests. The problems, therefore, are in capturing that substantive, disciplinary interest. And that's not easy, believe me!

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